Unity Pro

Motion Function Blocks
Block Library

07/2011

35010605.07

www.schneider-electric.com

Schneider Electric

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

No part of this document may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without express written permission of Schneider Electric.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

© 2011 Schneider Electric. All rights reserved.

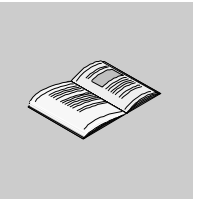
Document Set

Related Documents

Related Documentation:

- Unity Pro Online Help
- Unity Pro Online Help (MFBs using Unity Pro, Start-Up Guide)
- Lexium 05 Documentation CD delivered with the product
- Lexium 15 Documentation CD delivered with the product
- ATV 31 User Manual
- ATV 32 User Manual
- ICLA, IFxx User Manual
- ATV 71 User Manual
- Unilink L for Lexium 15LP and Unilink MH for Lexium 15MP/HP Online Help
- Lexium 32 documentation

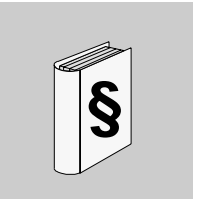
Table of Contents



	Safety Information	**7**
	About the Book	**9**
Part I	**General**	**11**
Chapter 1	**Block Types and their Applications**	**13**
	Block Types	14
	FFB Structure	16
	EN and ENO	19
Chapter 2	**Availability of the blocks on the various hardware platforms**	**23**
	Availability of Blocks on the Various Servodrives	23
Part II	**MFB blocks**	**27**
Chapter 3	**The RefAxis parameter**	**29**
	The Axis_Ref	30
	The status chart of the axis	31
Chapter 4	**Motion Function Block**	**33**
	MFB blocks and basic parameters	35
	CAN_HANDLER	39
	MC_READPARAMETER	41
	MC_WRITEPARAMETER	43
	MC_READACTUALPOSITION	45
	MC_READACTUALVELOCITY	47
	MC_READACTUALTORQUE	49
	MC_TORQUECONTROL	51
	MC_RESET	53
	MC_STOP	54
	MC_POWER	56
	MC_MOVEABSOLUTE	58
	MC_MOVERELATIVE	60
	MC_MOVEADDITIVE	62
	MC_MOVEVELOCITY	65
	MC_JOG	67
	MC_READAXISERROR	71

MC_READSTATUS 75
MC_HOME. 78
LXM_GEARPOS 80
LXM_GearPosS. 83
TE_UPLOADDRIVEPARAM 86
TE_DOWNLOADDRIVEPARAM 88
LXM_UPLOADMTASK 90
LXM_DOWNLOADMTASK 92
LXM_STARTMTASK 94
Units and Servodrives 96
Messaging Service. 98
Memory size. 100
Appendices 103
Appendix A Error Codes and Values 105
Tables of Error Codes for the Motion Function Block Library 105
Appendix B MFB performances 109
MFB Performance Table 109
Glossary 113
Index 133

Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

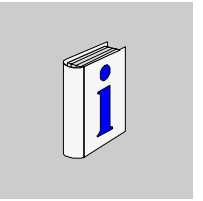
CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book



At a Glance

Document Scope

This manual presents the Motion Function Block (MFB) library using Unity Pro.

Validity Note

This documentation is valid from Unity Pro v6.0.

Product Related Information

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter, and apply this product.

Follow all local and national safety codes and standards.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

User Comments

We welcome your comments about this document. You can reach us by e-mail at techcomm@schneider-electric.com.

General

I

Overview

This section contains general information about the Motion Function Blocks (MFB).

What's in this Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
1	Block Types and their Applications	13
2	Availability of the blocks on the various hardware platforms	23

Block Types and their Applications

1

Overview

This chapter describes the different block types and their applications.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Block Types	14
FFB Structure	16
EN and ENO	19

Block Types

Block Types

Different block types are used in Unity Pro. The general term for the block types is FFB.

There are the following types of block:
- Elementary Function (EF)
- Elementary Function Block (EFB)
- Derived Function Block (DFB)
- Procedure

NOTE: Motion Function Blocks are not available on the Quantum platform.

Elementary Function

⚠ CAUTION

UNEXPECTED BEHAVIOR OF EQUIPMENT

Do not use links to connect function blocks outputs, when your application relies on persistent output data of an EF.

Failure to follow these instructions can result in injury or equipment damage.

Elementary functions (EF) have no internal status and one output only. If the input values are the same, the output value is the same for the executions of the function, e.g. the addition of two values gives the same result at every execution.

An elementary function is represented in the graphical languages (FBD and LD) as a block frame with inputs and an output. The inputs are represented on the left and the outputs on the right of the frame. The name of the function, i.e. the function type, is shown in the center of the frame.

The number of inputs can be increased with some elementary functions.

NOTE: The deactivation of an EF (EN=0) causes links connected to its Input/Output to be reset. To transfer the state of the signal do not use a link. A variable must be connected to the EF's output and must be used to connect the input of the element.

Elementary Function Block

Elementary function blocks (EFB) have an internal status. If the inputs have the same values, the value on the outputs can have another value during the individual executions. For example, with a counter, the value on the output is incremented.

An elementary function block is represented in the graphical languages (FBD and LD) as a block frame with inputs and outputs. The inputs are represented on the left and the outputs on the right of the frame. The name of the function block, i.e. the function block type, is shown in the center of the frame. The instance name is displayed above the frame.

Derived Function Block

Derived function blocks (DFBs) have the same properties as elementary function blocks. They are created by the user in the programming languages FBD, LD, IL and/or ST.

Procedure

Procedures are functions with several outputs. They have no internal state.

The only difference from elementary functions is that procedures can have more than one output and they support variables of the `VAR_IN_OUT` data type.

Procedures do not return a value.

Procedures are a supplement to IEC 61131-3 and must be enabled explicitly.

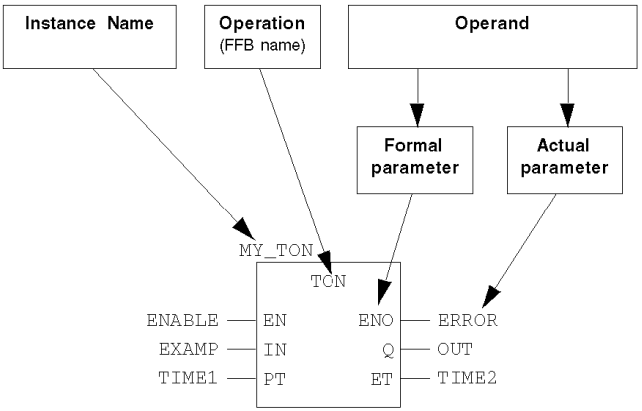
There is no visual difference between procedures and elementary functions.

FFB Structure

Structure

Each FFB is made up of an operation (name of the FFB), the operands are required for the operation (formal and actual parameters) and an instance name for elementary/derived function blocks.

Call of a function block in the FBD programming language:



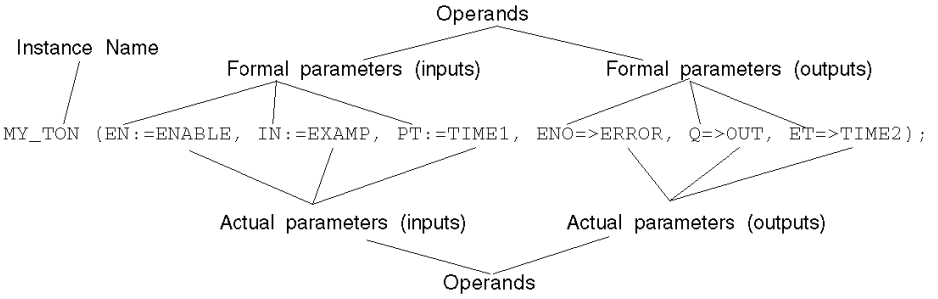
⚠ CAUTION

UNEXPECTED APPLICATION BEHAVIOR

Do not call several times the same block instance within a PLC cycle

Failure to follow these instructions can result in injury or equipment damage.

Formal call of a function block in the ST programming language:



Operation

The operation determines which function is to be executed with the FFB, e.g. shift register, conversion operations.

Operand

The operand specifies what the operation is to be executed with. With FFBs, this consists of formal and actual parameters.

Formal/actual parameters

Inputs and outputs are required to transfer values to or from an FFB. These are called formal parameters.

Objects are linked to formal parameters; these objects contain the current process states. They are called actual parameters.

At program runtime, the values from the process are transferred to the FFB via the actual parameters and then output again after processing.

The data type of the actual parameters must match the data type of the input/output (formal parameters). The only exceptions are generic inputs/outputs whose data type is determined by the actual parameter. If the actual parameters consist of literals, a suitable data type is selected for the function block.

FFB Call in IL/ST

In text languages IL and ST, FFBs can be called in formal and in informal form. Details can be found in the *Reference manual*.

Example of a formal function call:

```
out:=LIMIT (MN:=0, IN:=var1, MX:=5);
```

Example of an informal function call:

```
out:=LIMIT (0, var1, 5);
```

NOTE: The use of `EN` and `ENO` is only possible for formal calls.

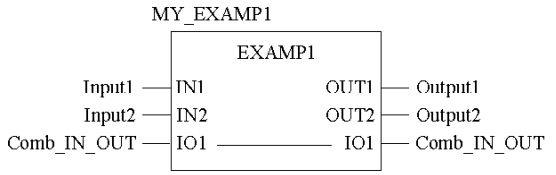
`VAR_IN_OUT` variable

FFBs are often used to read a variable at an input (input variables), to process it and to output the altered values of the **same** variable (output variables).

This special type of input/output variable is also called a `VAR_IN_OUT` variable.

The input and output variable are linked in the graphic languages (FBD and LD) using a line showing that they belong together.

Function block with VAR_IN_OUT variable in FBD:



Function block with VAR_IN_OUT variable in ST:

```
MY_EXAMP1 (IN1:=Input1, IN2:=Input2, IO1:=Comb_IN_OUT,
           OUT1=>Output1, OUT2=>Output2);
```

The following points must be considered when using FFBs with VAR_IN_OUT variables:

- The VAR_IN_OUT inputs must be assigned a variable.
- Literals or constants cannot be assigned to VAR_IN_OUT inputs/outputs.

The following additional limitations apply to the graphic languages (FBD and LD):

- When using graphic connections, VAR_IN_OUT outputs can only be connected with VAR_IN_OUT inputs.
- Only one graphical link can be connected to a VAR_IN_OUT input/output.
- Different variables/variable components can be connected to the VAR_IN_OUT input and the VAR_IN_OUT output. In this case the value of the variables/variable component on the input is copied to the output variables/variable component.
- No negations can be used on VAR_IN_OUT inputs/outputs.
- A combination of variable/address and graphic connections is not possible for VAR_IN_OUT outputs.

EN and ENO

Description

An EN input and an ENO output can be configured for the FFBs.

If the value of EN is equal to "0" when the FFB is invoked, the algorithms defined by the FFB are not executed and ENO is set to "0".

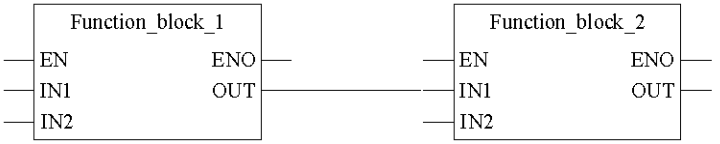
If the value of EN is equal to "1" when the FFB is invoked, the algorithms defined by the FFB will be executed. After the algorithms have been executed successfully, the value of ENO is set to "1". If certain error conditions are detected when executing these algorithms, ENO is set to "0".

If the EN pin is not assigned a value, when the FFB is invoked, the algorithm defined by the FFB is executed (same as if EN equals to "1"), Please refer to *Maintain output links on disabled EF (see Unity Pro, Operating Modes)*.

If the algorithms are executed successfully, then value of ENO is set to "1", else ENO is set to "0".

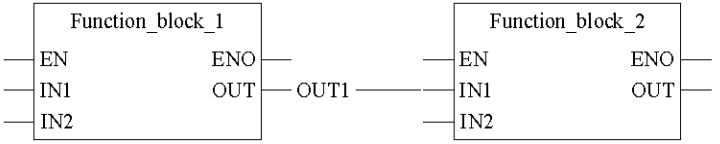
If ENO is set to "0" (caused by EN=0 or a detected error condition during execution or unsuccessful algorithm execution):

- Function blocks
  - EN/ENO handling with function blocks that (only) have one link as an output parameter:



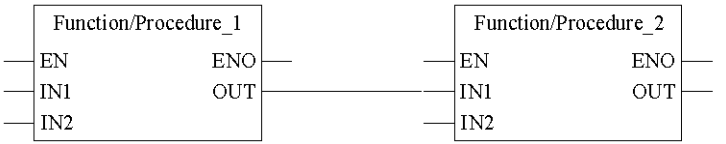
If EN from FunctionBlock_1 is set to "0", the output connection OUT from FunctionBlock_1 retains the status it had in the last correctly executed cycle.

  - EN/ENO handling with function blocks that have one variable and one link as output parameters:

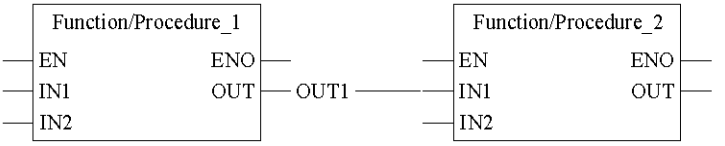


If EN from FunctionBlock_1 is set to "0", the output connection OUT from FunctionBlock_1 retains the status it had in the last correctly executed cycle. The variable OUT1 on the same pin, either retains its previous status or can be changed externally without influencing the connection. The variable and the link are saved independently of each other.

- Functions/Procedures
  As defined in IEC61131-3, the outputs from deactivated functions (EN-input set to "0") is undefined. (The same applies to procedures.)
  Here is an explanation of the output status in this case:
  - EN/ENO handling with functions/procedures that (only) have one link as an output parameter:



    If EN from Function/Procedure_1 is set to "0", the output connection OUT from Function/Procedure_1 is also set to "0".
  - EN/ENO handling with function blocks that have one variable and one link as output parameters:



    If EN from Function/Procedure_1 is set to "0", the output connection OUT from Function/Procedure_1 is also set to "0". The variable OUT1 on the same pin, either retains its previous status or can be changed externally without influencing the connection. The variable and the link are saved independently of each other.

The output behavior of the FFBs does not depend on whether the FFBs are called up without EN/ENO or with EN=1.

Conditional/Unconditional FFB Call

"Unconditional" or "conditional" calls are possible with each FFB. The condition is realized by pre-linking the input EN.

- EN connected
  conditional calls (the FFB is only processed if EN = 1)
- EN shown, hidden, and marked TRUE, or shown and not occupied
  unconditional calls (FFB is processed independent from EN)

NOTE: For disabled function blocks (EN = 0) with an internal time function (e.g. DELAY), time seems to keep running, since it is calculated with the help of a system clock and is therefore independent of the program cycle and the release of the block.

⚠ CAUTION
UNEXPECTED APPLICATION EQUIPMENT
Do not disable function blocks with internal time function during their operation.
Failure to follow these instructions can result in injury or equipment damage.

Note for IL and ST

The use of EN and ENO is only possible in the text languages for a formal FFB call, e.g.

```
MY_BLOCK (EN:=enable, IN1:=var1, IN2:=var2,
ENO=>error, OUT1=>result1, OUT2=>result2);
```

Assigning the variables to ENO must be done with the operator =>.

With an informal call, EN and ENO cannot be used.

Availability of the blocks on the various hardware platforms

2

Availability of Blocks on the Various Servodrives

Motion Function Blocks

Not all blocks are available on all hardware platforms. The blocks available on your Modicon M340 platform with CANopen fieldbus can be found in the following tables.

Type	Block name	ATV 31 ATV31 2 (7.)	ATV 32	ATV 71	Lexium 32	Lexium 05	Lexium 15 HP, MP, LP	IclA IFA, IFE, IFS
PLCopen motioncontrol V1.1	MC_ReadParameter	X	X	X	X	X	X	X
	MC_WriteParameter	X	X	X	X	X	X	X
	MC_ReadActualPosition				X	X	X	X
	MC_ReadActualVelocity (1.)	X	X	X	X	X	X	X
	MC_Reset	X	X	X	X	X	X	X
	MC_Stop	X	X	X	X	X	X	X
	MC_Power	X	X	X	X	X	X	X
	MC_MoveAbsolute				X	X	X	X
	MC_MoveRelative				X	X	X	
	MC_MoveAdditive				X	X		X
	MC_Home				X	X	X	X
	MC_MoveVelocity	X	X	X	X	X	X	X
	MC_ReadAxisError	X	X	X	X	X	X	X
	MC_ReadStatus	X	X	X	X	X	X	X
	MC_TorqueControl (1.)			X	X	X	X (3.)	
	MC_ReadActualTorque (1.)	X	X	X	X	X	X	
	MC_Jog (2.)				X	X	X (3.),except 15 LP	X
Parameter set save and restore functions for management of recipes or replacement of faulty servodrives	TE_UploadDriveParam	X	X	X	X(6.)	X	X	X
	TE_DownloadDriveParam	X	X	X	X(6.)	X	X	X

Type	Block name	ATV 31 ATV31 2 (7.)	ATV 32	ATV 71	Lexium 32	Lexium 05	Lexium 15 HP, MP, LP	IcIA IFA, IFE, IFS
Advanced functions for the **Lexium**	Lxm_GearPos					X(4.)	X(5.)	
	Lxm_GearPosS				X	X(4.)	X(5.)	
	Lxm_UploadMTask						X	
	Lxm_DownloadMTask						X	
	Lxm_StartMTask				X		X	
System function	CAN_Handler	X	X	X	X	X	X	X

1. PLCopen V0.99 extension part 2
2. Not PLCopen standard
3. Only for firmware version >= 6.73
4. Only for firmware version >= 1.403
5. Only for firmware version >= 2.36
6. The parameter list is a Lexium32Advanced drive parameter list
7. Through an ATV 31 V1.7 CANopen Device configuration.

MFB blocks

II

Subject of this Section

This section describes the MotionFunctionBlock library's functions and elementary function blocks.

What's in this Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
3	The RefAxis parameter	29
4	Motion Function Block	33

The RefAxis parameter

3

Subject of this Chapter

This chapter describes in detail the RefAxis parameter.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
The Axis_Ref	30
The status chart of the axis	31

The Axis_Ref

Description

An axis is defined using an AXIS_REF type object.

From the user's viewpoint, an AXIS_REF object is:

- A structured variable with all the data needed by the MFBs to work with an axis (logical status, mapping, messaging status, etc.),
- A variable created automatically during the creation *(see MFB using Unity Pro, Start-up Guide)* of the axis in the Unity Pro browser Movement *(see Unity Pro, Operating Modes)* directory,
- A variable to be addressed to MFB blocks.

The AXIS_REF object is represented by a DDT type structure that contains public data, which can therefore be modified by the axis configuration, as well as data that is not visible and that cannot be modified.

The visible data in AXIS_REF is:

Data	Type	Description
AxisReady	BOOL	Provides information on the initialization of Axis_Ref, as well as the availability of the device on the network.
AxisType	UINT	Servodrive type 1=Lexium, 2=Ifx, 3=ATV31, etc.
Axis_Reference	UINT	Device reference 1=MHDA1004, 2=MHDA1008, etc. Used to check data when using UploadParam and DownloadParam functions.
PlcTask	UINT	Task identification (1=MAST, 2=FAST).
NetworkType	UINT	Reserved
AxisMajorVersion	UINT	Integer part of the minimum version that the servodrive must have (e.g. the digit 6 in the number 6.43).
AxisMinorVersion	UINT	Decimal part of the minimum version that the configured servodrive must have (e.g. the number 43 in 6.43).
AxisMajorVersionRead	UINT	Integer part of the minimum version of the present servodrive (e.g. the number 6 in the number 6.5).
AxisMinorVersionRead	UINT	Decimal part of the minimum version that the servodrive has (e.g. the number 5 in the number 6.5).

The status chart of the axis

At a Glance

The inverters and servodrives are managed by the standard DRIVECOM state diagram. The Motion Function Blocks defines the behavior of the axis at a high level by a standard PLCopen state diagram. The MFB commands act on the axis' state diagram. The axis is always in one of the defined states. Any motion command is a transition that changes the states of the axis and, as a consequence, the way the current motion is computed.

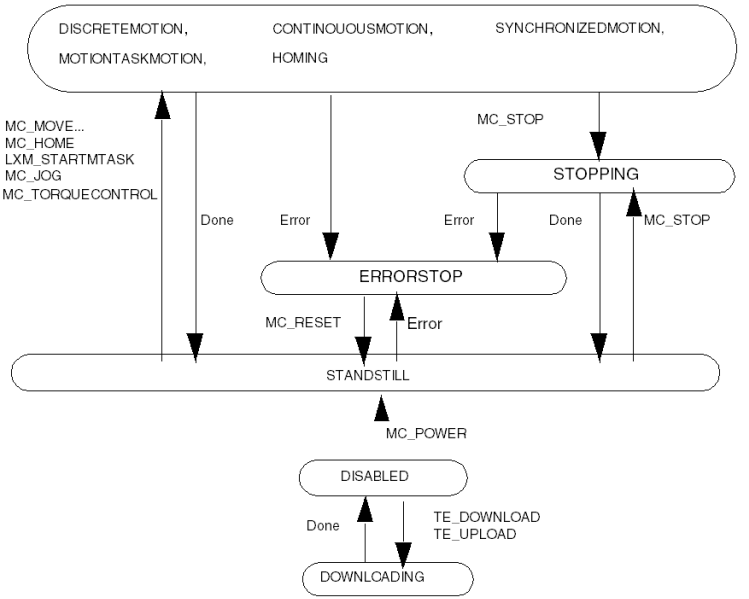
There are four main status values in this chart:

- disabled
- standstill
- errorstop
- stopping.

Other status values are described below.

The Chart

The Axis_Ref state chart is shown below:



Status Values

The following table describes the status values:

Status	Corresponds to
Disabled	Idle or initial status of the axis.
Standstill	Waiting status of the axis, it is powered up and is error-free.
Discrete Motion	Discrete motion in progress.
Continuous Motion	Continuous motion in progress.
Synchronized Motion	Synchronized motion in progress.
MotionTask Motion	Current motion task program.
Downloading	Parameters or motion tasks currently being transferred between the PLC and the servodrive memory.
Homing	The axis is executing a homing.
Stopping	Valid during the execution of the axis' MC_STOP, the Done and the non-execution of MC_STOP brings the Axis_Ref to the Standstill status.
Errorstop	Valid during the axis stop due to an error, before the error has been acknowledged.

Motion Function Block

4

Overview

This chapters presents the various blocks in the Motion Function Blocks library.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
MFB blocks and basic parameters	35
CAN_HANDLER	39
MC_READPARAMETER	41
MC_WRITEPARAMETER	43
MC_READACTUALPOSITION	45
MC_READACTUALVELOCITY	47
MC_READACTUALTORQUE	49
MC_TORQUECONTROL	51
MC_RESET	53
MC_STOP	54
MC_POWER	56
MC_MOVEABSOLUTE	58
MC_MOVERELATIVE	60
MC_MOVEADDITIVE	62
MC_MOVEVELOCITY	65
MC_JOG	67
MC_READAXISERROR	71
MC_READSTATUS	75
MC_HOME	78
LXM_GEARPOS	80
LXM_GearPosS	83

Topic	Page
TE_UPLOADDRIVEPARAM	86
TE_DOWNLOADDRIVEPARAM	88
LXM_UPLOADMTASK	90
LXM_DOWNLOADMTASK	92
LXM_STARTMTASK	94
Units and Servodrives	96
Messaging Service	98
Memory size	100

MFB blocks and basic parameters

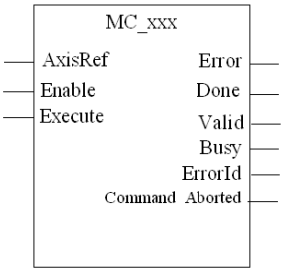
General

The majority of blocks use the same input and output parameters, deemed basic.

The operating principle of the basic input and output parameters is explained below.

Representation in FBD

Representation:



Description of the Standard Input Parameters

The following table describes the input parameters:

Parameter	Type	Comment
`Axis`	`AXIS_REF`	Axis_Ref *(see page 30)* type object, which defines the device
`Enable`	`BOOL`	When `Enable` is `TRUE`, the parameters are taken into account and the function is executed. As soon as `Enable` is `FALSE`, the output parameters, `Error`, `Done` and `CommandAborted`, are immediately set to `FALSE`.
`Execute`	`BOOL`	On an `Execute` rising edge, the parameters are taken into account and the function is executed. When `Execute` is `TRUE`, the output parameters, `Error`, `Done`, `CommandAborted` and `Busy` are controlled by the block. When `Execute` is `FALSE`, the `Busy` output parameter is `TRUE` until the end of the block execution. As soon as one of the `Error`, `Done`, or `CommandAborted` output parameters changes to `TRUE`, they all become `FALSE`.

Description of the Standard Output Parameters

The following table describes the output parameters:

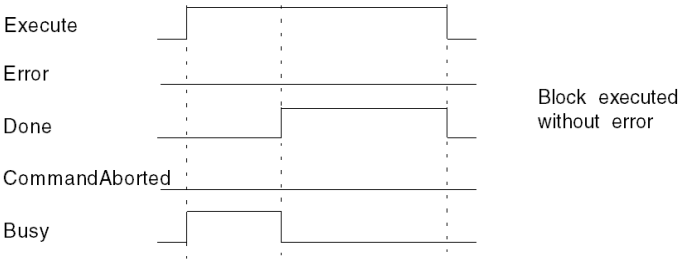
Parameter	Type	Comment
Error	BOOL	Error is TRUE when an execution error is detected by the function block.
Done	BOOL	Done is TRUE when the execution of the function is completed.
Valid	BOOL	Valid is TRUE when the others are enabled.
Busy	BOOL	Busy is TRUE to indicate that the execution of the function block is in progress. Busy is set to TRUE when Execute switches to TRUE (on a rising edge), and is set to FALSE when one of the following status values, Done, Error, or CommandAborted switches to TRUE.
ErrorId	INT	Error identifier.
CommandAborted	BOOL	CommandAborted is TRUE when the execution of the block is cancelled. This cancellation is due to the execution of another command.

NOTE: The type of the output parameter ErrorId (Error Identifier *(see page 105)*) is UDINT for the blocks that use messaging (MC_READ..., MC_WriteParameter and CAN_HANDLER).

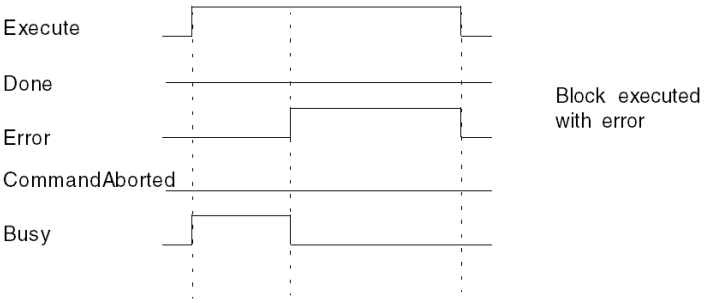
All blocks have the propriety of recording the last ERRID error in the Unity DIAG BUFFER.

Block operation with an Execute input parameter.

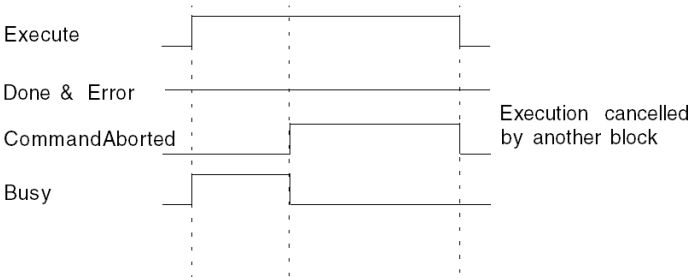
The figure below shows the time diagram of a block including an Execute input parameter set to 1 until the block execution has completed (DONE=0 and BUSY=0), the block executes without any errors:



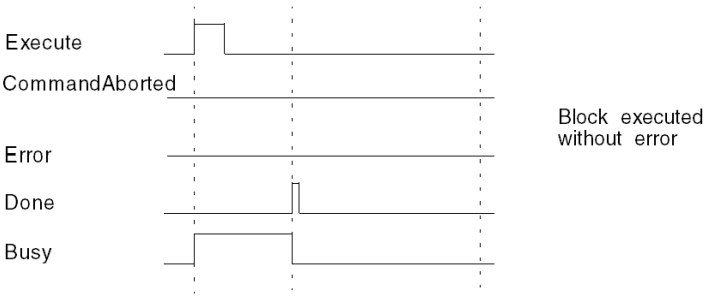
The figure below shows the time diagram of a block including an `Execute` input parameter set to 1 until the block execution has completed (`ERROR`=0 and `BUSY`=0), the block executes with errors:



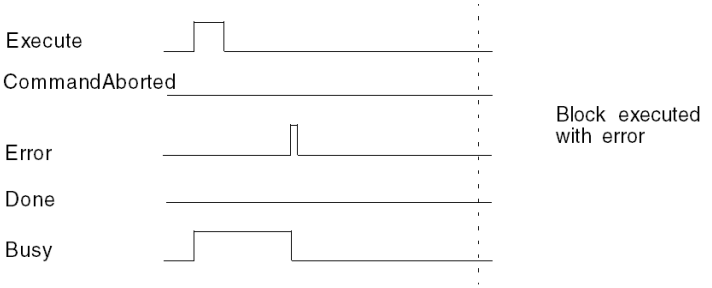
The figure below shows the time diagram of a block including an `Execute` input parameter set to 1 until the block execution has completed (`COMMANDABBORTED`=0 and `BUSY`=0), the block execution was cancelled:



The figure below shows the time diagram of a block including an `Execute` input parameter set to 1 on a PLC cycle, the block executes without any errors:

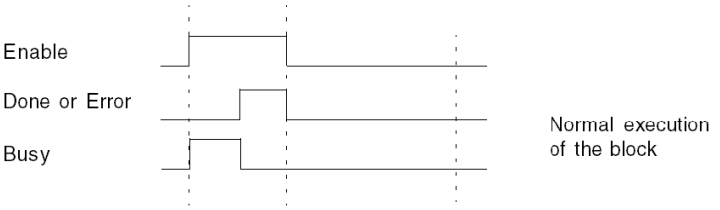


The figure below shows the time diagram of a block including an `Execute` input parameter set to 1 on a PLC cycle, the block executes with any errors:

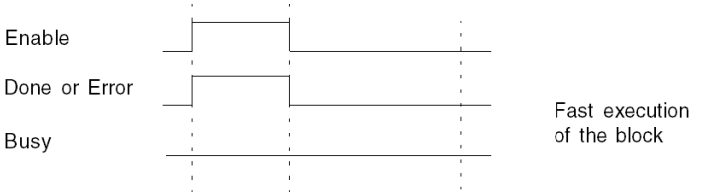


Block operation with an `Enable` input parameter

The figure below shows the time diagram of a block including an `Enable` input parameter, execution is fast:



The figure below shows the time diagram of a block including an `Enable` input parameter, execution is normal (more than one PLC cycle):



CAN_HANDLER

Function Description

The CAN_HANDLER function is used to check the CANopen communication and that the software and physical configurations are consistent.

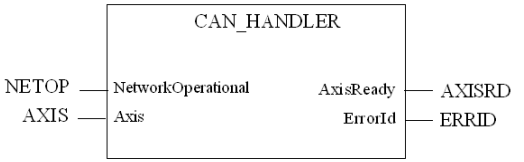
This function must be called before any call to any MFB, because it determines the correct operation of all other MFBs.

NOTE: This block must not be instantiated manually.It is automatically created when an axis is created in the Motion directory *(see MFB using Unity Pro, Start-up Guide)*.

NOTE: The axis parameter must be the corresponding AxisRef defined when the axis is created in the Motion directory.

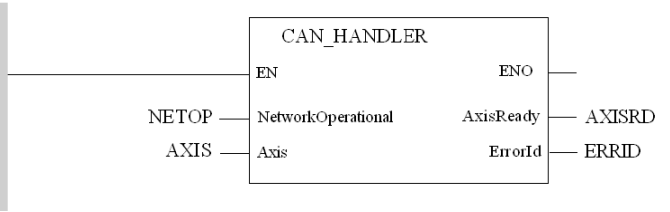
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
CAL CAN_HANDLER(NETOP:=NetworkOperational, AXIS:=Axis,
AXISRD=>AxisReady, ERRID=>ErrorId)
```

Representation in ST

Representation:

```
CAN_HANDLER(AXIS:=Axis, NETOP:=NetworkOperational,
AXISRD=>AxisReady, ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameter that is in addition to the basic parameters *(see page 35)*:

Parameter	Type	Comment
`NetworkOperational`	`BOOL`	Correct operation of the CANopen bus' equation result.

NOTE: Assignment of this parameter is left to the discretion of the developer. It depends on the CANopen bus management philosophy.

It is recommended to use an object (or an equation) taken from the IODDT of the TSX CPP110 card (type T_COM_CPP110) for Premium and of the Modicon M340 CANopen port (type T_COM_CO_BMX). For example, it is possible to assign the `SLAVE_ACTIV_X` bit taken from the IODDT T_COM_CPP110 (where X is the device's CANopen address).

Description of the Output Parameters

The following table describes the output parameter that is in addition to the basic parameters *(see page 35)*:

Parameter	Type	Comment
`AxisReady`	`BOOL`	The software configuration is consistent with the current hardware configuration and the CANopen bus is OK.

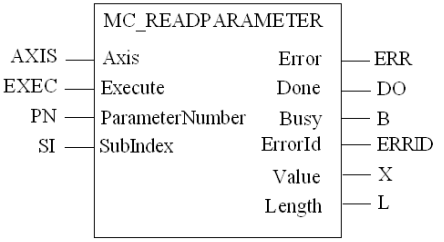
MC_READPARAMETER

Function Description

The `MC_READPARAMETER` function is used to read, via Service Data Object (SDO) messaging, a variable in the servodrive defined by the `Axis` parameter.

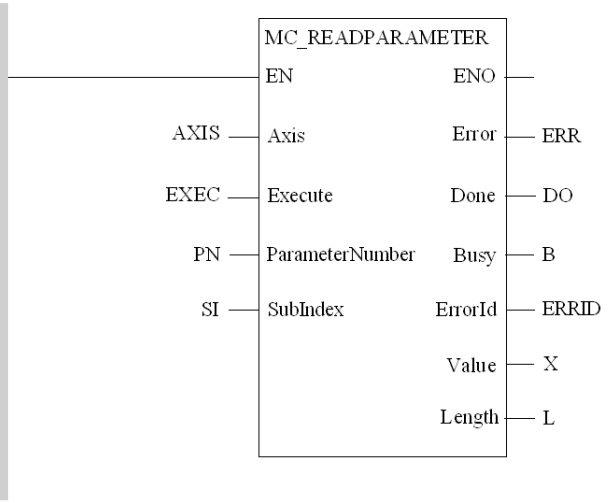
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis

CAL MC_READPARAMETER (AXIS:=Axis, EXEC:=Execute,
PN:=ParameterNumber, SI:=SubIndex, ERR=>Error, DO=>Done,
B=>Busy, ERRID=>ErrorId, X=>Value, L=>Length)
```

Representation in ST

Representation:

```
MC_ReadParameter(AXIS:=Axis, EXEC:=Execute, PN:=Parameter-
Number, SI:=SubIndex, ERR=>Error, DO=>Done, B=>Busy,
ERRID=>ErrorId, X=>Value, L=>Length);
```

Description of the Input Parameters

The following table describes the input parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
ParameterNumber	UINT	CANopen Index number.
SubIndex	UINT	CANopen sub-index number.

Description of the Output Parameters

The following table describes the output parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
Value	DINT	Value read.
Length	UINT	Length in bytes of the value read.

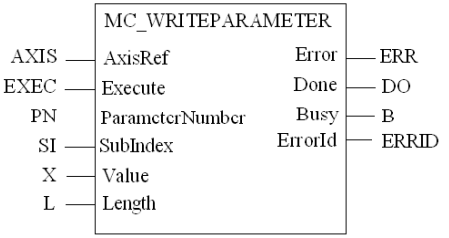
MC_WRITEPARAMETER

Function Description

The `MC_WRITEPARAMETER` function is used to write, via System Data Object (SCO) messaging, a variable in the servodrive defined by the `Axis` parameter.

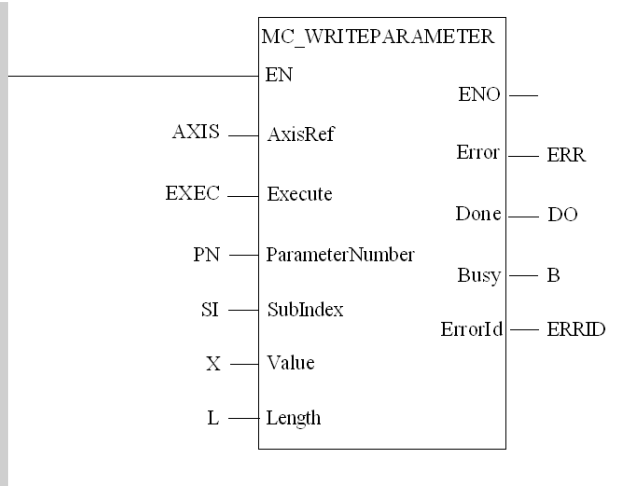
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_WRITEPARAMETER(AXIS:=Axis, EXEC:=Execute,
PN:=ParameterNumber, SI:=SubIndex, X:=Value, L:=Length,
ERR=>Error, DO=>Done, B=>Busy, ERRID=>ErrorId)
```

Representation in ST

Representation:

```
MC_WRITEPARAMETER(AXIS:=Axis, EXEC:=Execute, PN:=Parameter-
Number, SI:=SubIndex, X:=Value, L:=Length, ERR=>Error,
DO=>Done, B=>Busy, ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
ParameterNumber	UINT	CANopen index number to be written.
SubIndex	UINT	CANopen sub-index number.
Value	DINT	Value to write.
Length	UINT	Length in bytes of the value to write.

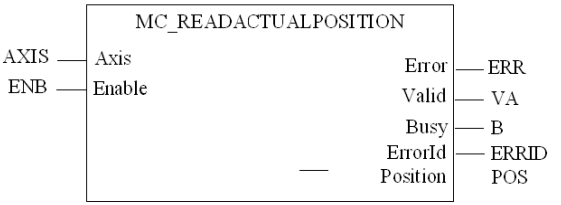
MC_READACTUALPOSITION

Function Description

The MC_READACTUALPOSITION function is used to read the axis position.

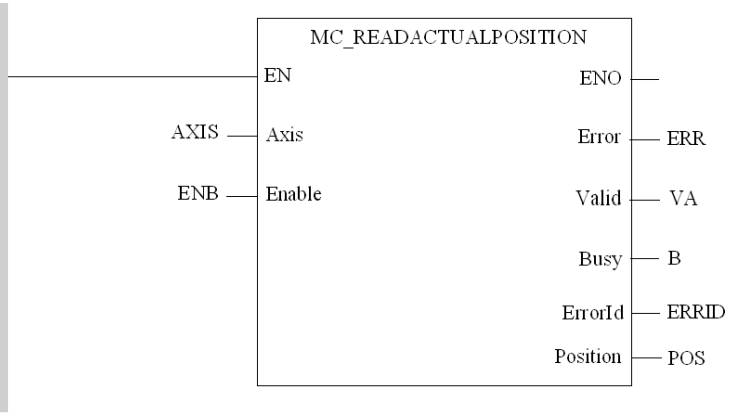
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_READACTUALPOSITION(AXIS:=Axis, ENB:=Enable,
ERR=>Error, VA=>Valid, B=>Busy, ERRID=>ErrorId,
POS=>Position)
```

Representation in ST

Representation:

```
MC_READACTUALPOSITION(AXIS:=Axis, ENB:=Enable, ERR=>Error,
VA=>Valid, B=>Busy, ERRID=>ErrorId, POS=>Position);
```

Description of the Output Parameters

The following table describes the output parameter that is in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
`Position`	`DINT`	Position of the axis, if `Valid` is `TRUE`.

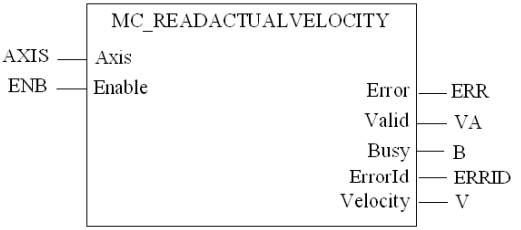
MC_READACTUALVELOCITY

Function Description

The MC_READACTUALVELOCITY function is used to determine the current speed of the axis.

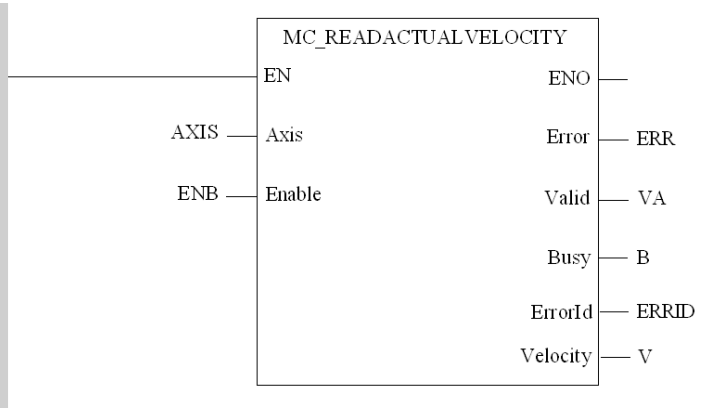
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_READACTUALVELOCITY(AXIS:=Axis, ENB:=Enable,
ERR=>Error, VA=>Valid, B=>Busy, ERRID=>ErrorId, V=>Velocity)
```

Representation in ST

Representation:

```
MC_READACTUALVELOCITY(AXIS:=Axis, ENB:=Enable, ERR=>Error,
VA=>Valid, B=>Busy, ERRID=>ErrorId, V=>Velocity);
```

Description of the Output Parameters

The following table describes the output parameter that is in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
`Velocity`	`DINT`	Speed of the axis, when `Valid` is TRUE.

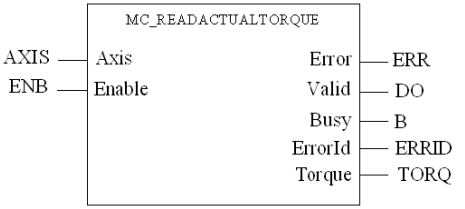
MC_READACTUALTORQUE

Function Description

The `MC_ReadActualTorque` function is used to return the current torque.

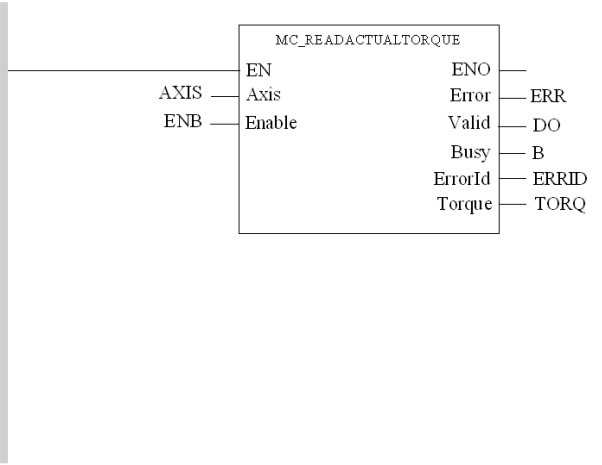
Representation in FBD

Representation



Representation in LD

Representation



Representation in IL

Representation:

```
LD Slave
CAL MC_READACTUALTORQUE(AXIS:=Axis, ENB:=Enable, ERR=>Error,
DO=>Valid, B=>Busy, ERRID=>ErrorId), TORQ=>Torque
```

Representation in ST

Representation:

```
MC_READACTUALTORQUE(AXIS:=Axis, EXEC:=Execute, ERR=>Error,
DO=>Valid, B=>Busy, ERRID=>ErrorId), TORQ=>Torque;
```

Description of the Output Parameters

The following table describes the output parameters that are in addition to the basic parameters *(see page 35)*:

Parameter	Type	Comment
`Torque`	`INT`	Updated every 200ms.

The following table describes the units for each drive

Drive	15MP/HP	15LP	Lex05 / Lex32	Icla	ATV31	ATV71
Unit	1/1000 rated torque	1/100 Amp	0.01 Nominal Motor Torque	-	0.01 Nominal Torque	0.01 Nominal Torque

NOTE: The returned value for the Lexium05 and Lexium32 is a current.

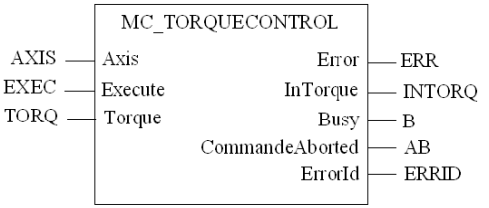
MC_TORQUECONTROL

Function Description

The MC_TORQUECONTROL function is used to set the drive in TORQUECONTROL mode if it is not already the case, and provide a torque command value.This function block continuously applies a torque or force, and sets the InTorque output if the torqur level is reached. This function block is applicable for force and torque. When no external load is applicable, positive torque is in the positive direction of velocity.

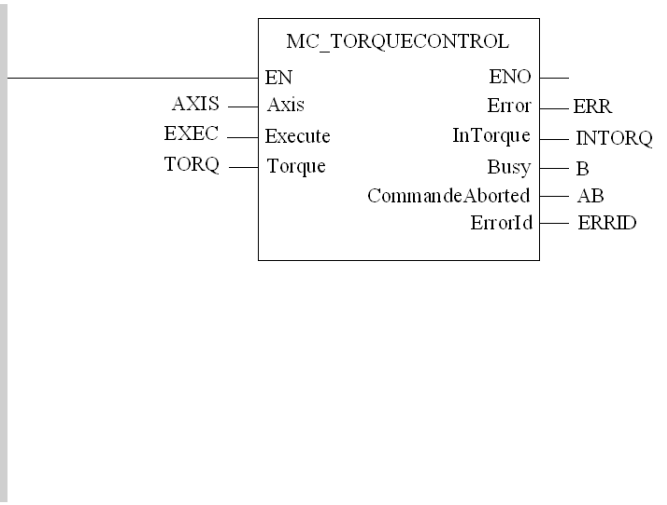
Representation in FBD

Representation



Representation in LD

Representation



Representation in IL

Representation:

```
LD Slave
CAL MC_TORQUECONTROL(AXIS:=Axis, EXEC:=Execute, TORQ:=Torque,
ERR=>Error, INTORQ=>InTorque, B=>Busy, AB=>CommandeAborted,
ERRID=>ErrorId)
```

Representation in ST

Representation:

```
MC_TORQUECONTROL(AXIS:=Axis, EXEC:=Execute, TORQ:=Torque,
ERR=>Error, INTORQ=>InTorque, B=>Busy, AB=>CommandeAborted,
ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameters that are in addition to the basic parameters *(see page 35)*:

Parameter	Type	Comment
`Torque`	`INT`	Torque value.

The following table describes units for each drive.

Drive	Lexium 15MM/ HP	Lexium 15LP	Lexium 05 / Lexium 32	ATV 71
Unit	1/1000 rated torque	1/1000 rated torque	0.01 Amp	1/1000 nominal motor torque

Description of the Output Parameters

The following table describes the output parameters that are in addition to the basic parameters *(see page 35)*:

Parameter	Type	Comment
`InTorque`	`BOOL`	`InTorque` is `TRUE` when the axis reaches the `Torque` in TorqueControl mode, otherwise it remains set to `FALSE`.(not significant for Lexium05).

NOTE: The ATV71 allows two ways to manage the torque mode: torque or speed regulation. Switching beetween these two modes is possible either by LI or by frequency level. LI is a digital or virtual input composed of the three MSB of the ControlWord (Bit15 to 13). When activated, this MFB will always set the bit 15 to 1. Depending on the drive configuration, both ways of switching will then be available.

MC_RESET

Function Description

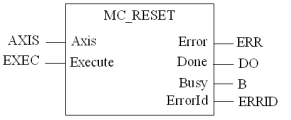
The MC_RESET function is used to acknowledge the internal defaults (AxisFault) or internal alerts (AxisWarning) resulting of an execution of a MFB for the axis (Axis_ref). The function resets the contents of the ReadAxisError block, which contains the diagnostic information.

In the chart status, the function allows to change from the Errorstop state to the Standstill *(see page 31)* state.

The input and output parameters *(see page 35)* are basic parameters.

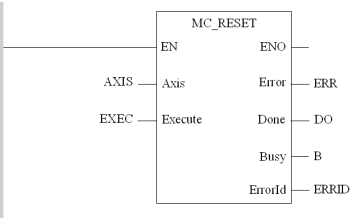
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_RESET(AXIS:=Axis, EXEC:=Execute, ERR=>Error, DO=>Done,
B=>Busy, ERRID=>ErrorId)
```

Representation in ST

Representation:

```
MC_RESET(AXIS:=Axis, EXEC:=Execute, ERR=>Error, DO=>Done,
B=>Busy, ERRID=>ErrorId);
```

MC_STOP

Function Description

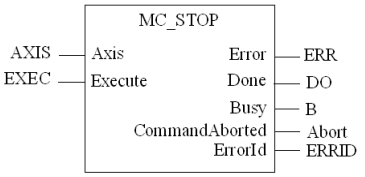
The MC_STOP function is used to stop any motion in progress and place the Axis_Ref in Stopping status *(see page 31)*.

As soon as the axis is at zero speed, the output parameter DONE is set to TRUE, and the axis is therefore in stopping status. The Axis_Ref moves into Standby status if the input parameter returns to FALSE.

The input and output parameters of the block are basic parameters *(see page 35)*.

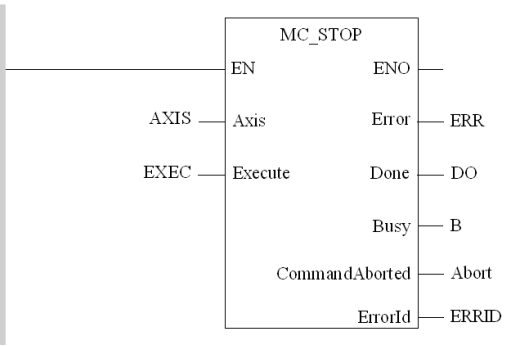
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_STOP(AXIS:=Axis, EXEC:=Execute, ERR=>Error, DO=>Done,
B=>Busy, Abort=>CommandAborted, ERRID=>ErrorId)
```

Representation in ST

Representation:

```
MC_STOP(AXIS:=Axis, EXEC:=Execute, ERR=>Error, DO=>Done,
B=>Busy, Abort=>CommandAborted, ERRID=>ErrorId);
```

Stop on Z Axis

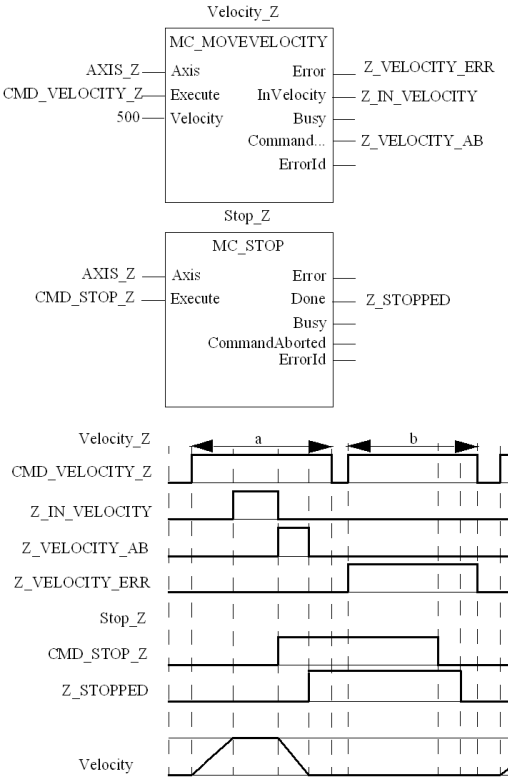
The example below shows how the MC_STOP behaves in combination with MC_MOVEVELOCITY.

The graph below shows the timing chart for the example with:

a) A rotating axis stopped with an MC_Stop MFB

b) The axis rejects the move command when the Execute parameter of the MC_STOP block equals 1. The MC_MOVEVELOCITY MFB raises an error indicating that the MC_STOP command is active.

The graph below shows the timing chart for stopping the axis:



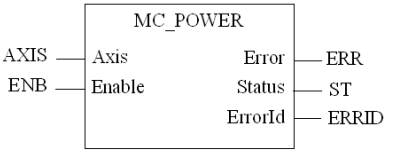
MC_POWER

Function Description

The `MC_POWER` function is used to move the `Axis_Ref` status from Disabled *(see page 31)* to Standstill.

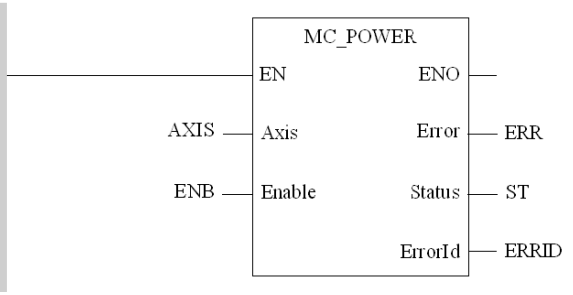
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_POWER(AXIS:=Axis, ENB:=Enable, ERR=>Error, ST=>Status,
ERRID=>ErrorId)
```

Representation in ST

Representation:

```
MC_POWER(AXIS:=Axis, ENB:=Enable, ERR=>Error, ST=>Status,
ERRID=>ErrorId);
```

Description of the Output Parameters

The following table describes the output parameter that is in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
`Status`	`BOOL`	If `Status` is set to `TRUE`, the status is Standstill *(see page 31)*. If `Status` is set to `FALSE`, the status is Disabled *(see page 31)*.

MC_MOVEABSOLUTE

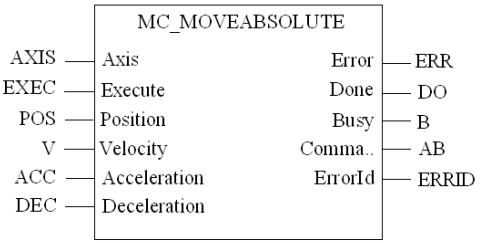
Function Description

The `MC_MOVEABSOLUTE` function is used to execute a move to absolute position command.

`Done` equals `TRUE` if the position is reached and the speed equals zero.

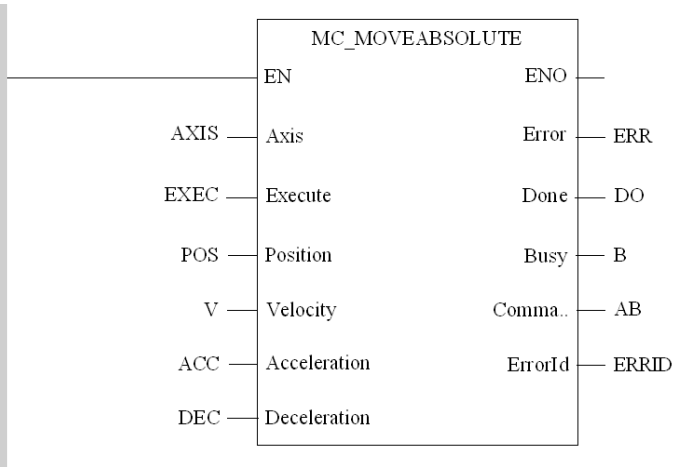
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_MOVEABSOLUTE(AXIS:=Axis, EXEC:=Execute, POS:=Position,
V:=Velocity, ACC:=Acceleration, DEC:=Deceleration,
ERR=>Error, DO=>Done, B=>Busy, AB=>CommandAborted,
ERRID=>ErrorId)
```

Representation in ST

Representation:

```
MC_MOVEABSOLUTE(AXIS:=Axis, EXEC:=Execute, POS:=Position,
V:=Velocity, ACC:=Acceleration, DEC:=Deceleration,
ERR=>Error, DO=>Done, B=>Busy, AB=>CommandAborted,
ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
`Position`	`DINT`	Value specifying the position of the servodrive.
`Velocity`	`UDINT`	Speed value.
`Acceleration`	`UDINT`	Acceleration value.
`Deceleration`	`UDINT`	Deceleration value.

NOTE: The value 0 for the acceleration and deceleration parameters allows you to use the value configured in the servodrive. If the value is other than 0, the servodrive takes this value into account.

NOTE: For the Icla, the acceleration value is the same for acceleration and deceleration. The type is `UINT`. The deceleration parameter is not active.

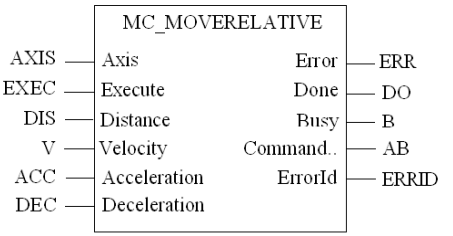
MC_MOVERELATIVE

Function Description

The MC_MOVERELATIVE function is used to execute a move to relative position command (in relation to the current position of the servodrive).

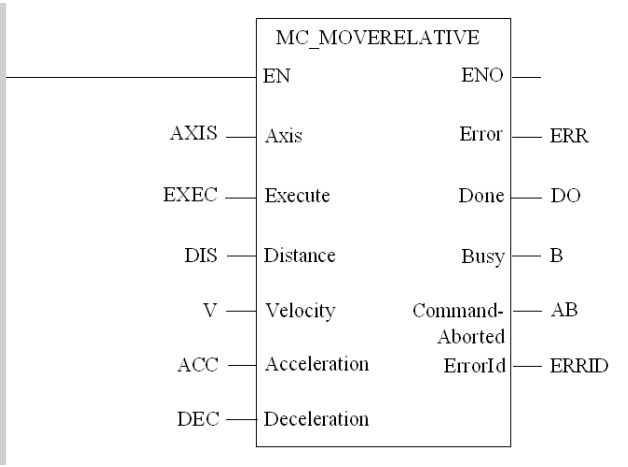
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_MOVERELATIVE(AXIS:=Axis, EXEC:=Execute, DIS:=Distance,
V:=Velocity, ACC:=Acceleration, DEC:=Deceleration,
ERR=>Error, DO=>Done, B=>Busy, AB=>CommandAborted,
ERRID=>ErrorId)
```

Representation in ST

Representation:

```
MC_MOVERELATIVE(AXIS:=Axis, EXEC:=Execute, DIS:=Distance,
V:=Velocity, ACC:=Acceleration, DEC:=Deceleration,
ERR=>Error, DO=>Done, B=>Busy, AB=>CommandAborted,
ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
`Distance`	`DINT`	Value specifying the distance that the servodrive must cover.
`Velocity`	`UDINT`	Speed value.
`Acceleration`	`UDINT`	Acceleration value.
`Deceleration`	`UDINT`	Deceleration value.

NOTE: The value 0 for the acceleration and deceleration parameters allows you to use the value configured in the servodrive. If the value is other than 0, the servodrive takes this value into account.

MC_MOVEADDITIVE

Function Description

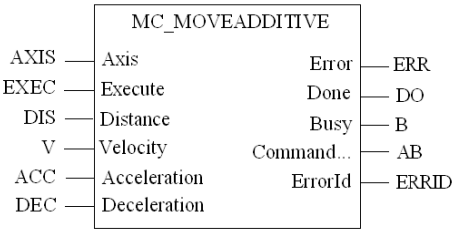
The MC_MOVEADDITIVE function is used to apply an additional move command to a servodrive that is already in motion.

As soon as the block's input parameter Execute is active:

- the MC_MOVEADDITIVE block takes control over the currently moving block (MC_MOVERELATIVE or MC_MOVE_ABSOLUTE),
- the value entered in the Distance parameter is added to the target value of the current movement,
- the Velocity, Acceleration and Deceleration input parameters are taken into account immediately.

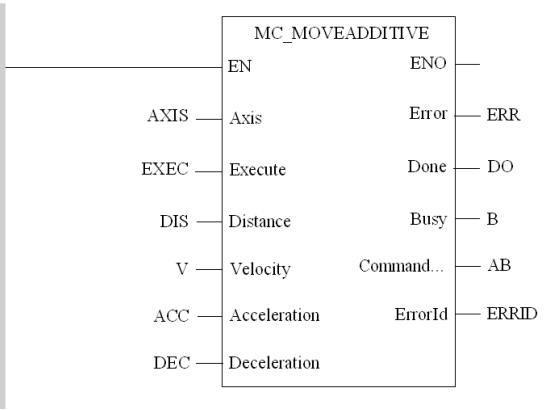
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_MOVEADDITIVE(AXIS:=Axis, EXEC:=Execute, DIS:=Distance,
V:=Velocity, ACC:=Acceleration, DEC:=Deceleration,
ERR=>Error, DO=>Done, B=>Busy, AB=>CommandAborted,
ERRID=>ErrorId)
```

Representation in ST

Representation:

```
MC_MOVEADDITIVE(AXIS:=Axis, EXEC:=Execute, DIS:=Distance,
V:=Velocity, ACC:=Acceleration, DEC:=Deceleration,
ERR=>Error, DO=>Done, B=>Busy, AB=>CommandAborted,
ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameters that are in addition to the basic *(see page 35)* parameters:

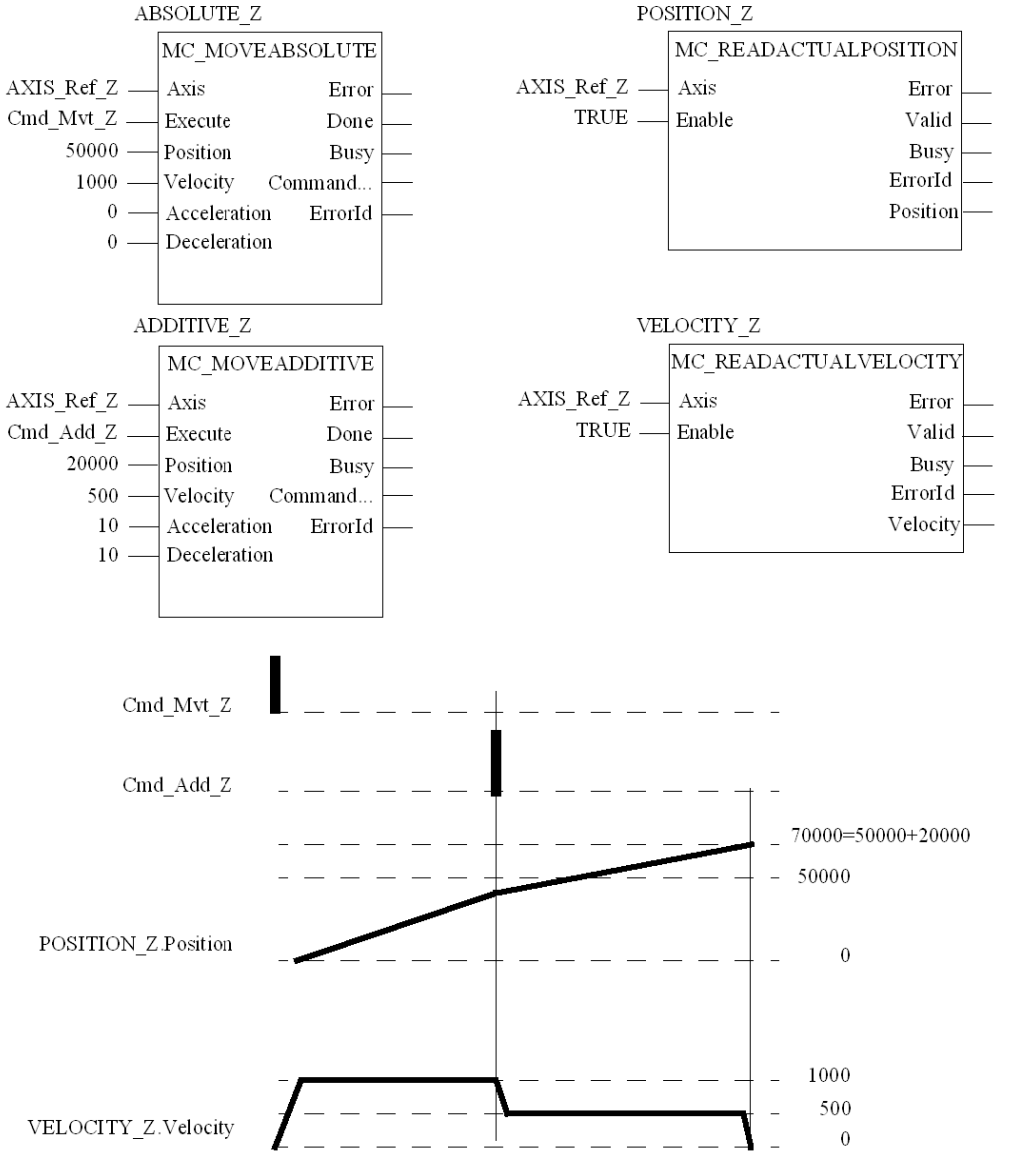
Parameter	Type	Comment
`Distance`	`DINT`	Value specifying the additional distance to cover.
`Velocity`	`UDINT`	Speed value.
`Acceleration`	`UDINT`	Acceleration value.
`Deceleration`	`UDINT`	Deceleration value.

NOTE: The value 0 for the acceleration and deceleration parameters allows you to use the value configured in the servodrive. If the value is other than 0, the servodrive takes this value into account.

NOTE: For the Icla, the acceleration value is the same for acceleration and deceleration. The type is `UINT`. The deceleration parameter is not active.

Example

The graph below illustrates the operation of the MC_MOVEADDITIVE block in combination with a MC_MOVE_ABSOLUTE movement block.



MC_MOVEVELOCITY

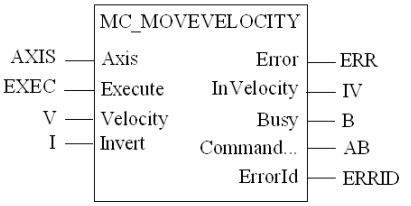
Function Description

The MC_MOVEVELOCITY function is used to execute an endless move command at a given speed. To use this function, the current axis state must be continuous or StandStill.

This block, in combination with the MC_STOP block *(see page 54)* can be used in manual mode.

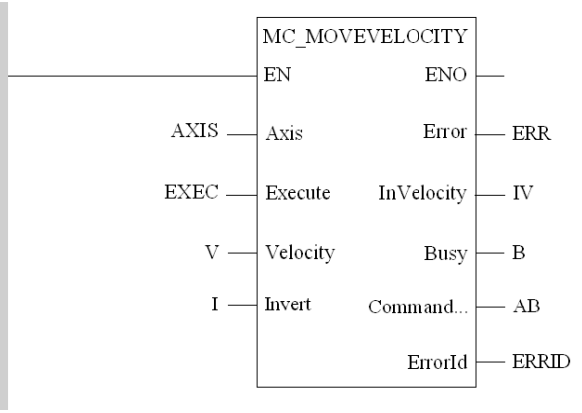
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_MOVEVELOCITY(AXIS:=Axis, EXEC:=Execute, V:=Velocity,
I:=Invert, ERR=>Error, IV=>InVelocity, B=>Busy,
AB=>CommandAborted, ERRID=>ErrorId)
```

Representation in ST

Representation:

```
MC_MOVEVELOCITY(AXIS:=Axis, EXEC:=Execute, V:=Velocity,
I:=Invert, ERR=>Error, IV=>InVelocity, B=>Busy,
AB=>CommandAborted, ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameters that are in addition to the basic parameters *(see page 35)*:

Parameter	Type	Comment
`Velocity`	`DINT`	Speed value. For ICLA or ATV31 servodrives, the `Velocity` parameter is used as `INT` type.
`Invert`	`Bool`	Direction of rotation. If `Invert` is set to `TRUE`, the direction is the inverse of the `Velocity` sign. When `Invert` is set to `FALSE`, the direction is that of the `Velocity`.

Description of the Output Parameters

The following table describes the output parameters that are in addition to the basic parameters *(see page 35)*:

Parameter	Type	Comment
`InVelocity`	`BOOL`	`InVelocity` is `TRUE` when the `Velocity` speed is reached, otherwise it remains set to `FALSE`.

MC_JOG

Function Description

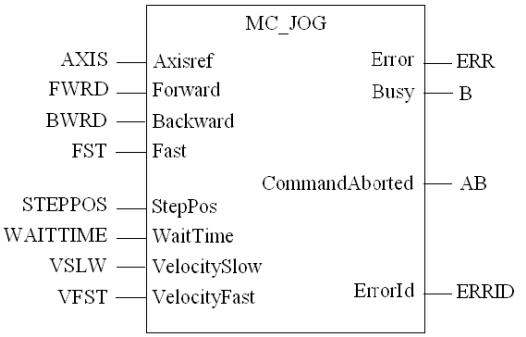
The MC_JOG function is used to set the drive in Position mode if it is not already the case, and provide a direction and a speed command value. This function is accepted only if the State diagram is in **STANDSTILL** state.

This function allows:

- Moving by position step or continuously (Lexium05, Lexium32 and Icla),
- Moving out of the LimitSwitch (Lexium05 and Icla) in case of LimitSwitch detected error situation:
  - When starting the movement in the appropriate direction, the axis state is commuted into homing state.
  - In case of release of MC_Home before being out of the LimitSwitch, an errorID 8 will appear. A MC_Reset command is necessary before doing another MC_JOG function.

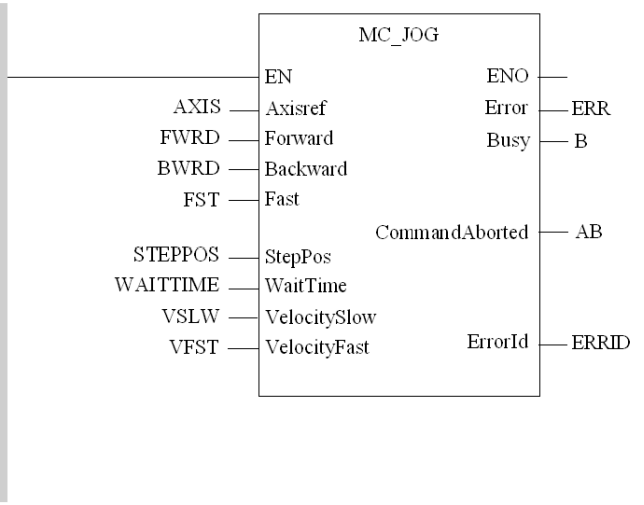
Representation in FBD

Representation



Representation in LD

Representation



Representation in IL

Representation:

```
LD Slave
CAL MC_JOG(AXIS:=Axis, FWRD:=Forward, BWRD:=Backward,
FST:=Fast, STEPPOS:=StepPos, WAITTIME:=WaitTime,
VSLW:=VelocitySlow, VFST:=VelocityFast, ERR=>Error, B=>Busy,
AB=>CommandAborted, ERRID=>ErrorId)
```

Representation in ST

Representation:

```
MC_JOG(AXIS:=Axis, FWRD:=Forward, BWRD:=Backward, FST:=Fast,
STEPPOS:=StepPos, WAITTIME:=WaitTime, VSLW:=VelocitySlow,
VFST:=VelocityFast, ERR=>Error, B=>Busy, AB=>CommandAborted,
ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameters that are in addition to the basic parameters *(see page 35)*:

Parameter	Type	Comment
Forward	BOOL	Forward operating direction.
Backward	BOOL	Backward operating direction.
Fast	BOOL	Jog speed selection.
StepPos	INT	Jogging path until continuous running.
WaitTime	INT	Waiting period until continuous running.
VelocitySlow	UDINT	Speed for slow movement. Must always be connected.
VelocityFast	UDINT	Speed for fast movement. Must always be connected.

For Lexium15MP and Lexium 15HP, StepPos and WaitTime inputs are not significant.

When both inputs are active, the block detects the mismatch and sets the value 10 as error code: Bad condition for Jog Direction *(see page 105)*.

For Lexium05 and Lexium32 StepPos and WaitTime inputs:
- Must be set,
- Are sent by SDO,
- Are not sent if the value is equal to -1, it signifies that update of this parameter is not required, and the MFB will work with the actual value of these parameter already inside the drive.

The input Fast allows selecting between VelocitySlow and VelocityFast.

Function Behavior

Both inputs Forward/Backward are edge active:
- Rising edge makes the movement start,
- Falling edge makes the movement stop.

Parameter Description for the Lexium 05

Group.Name Index:Subindex dec. (hex.)	Meaning Bit assignment	Units Range ?
FastSpeed NFST JOG-nFSt	Speed for fast manual movement(8-16) The adjustment value is limited in internal on the actual parameters adjustment in RAMPn_max.	tr/min 1 180 13200
SlowSpeed NSLW JOG-nSLu	Speed for slow manual movement(8-16) The adjustment value is limited in internal on the actual parameters adjustment in RAMPn_max.	tr/min 1 60 13200
StepPos	Jogging path with manual start before the continuous running 0: direct activation of continuous running >0: distance positining by manual cycle	usr 0 20
WaitTime	Waiting period until continuous running(8-16) Only effective if jogging path is set not equal to 0	ms 1 500 32767

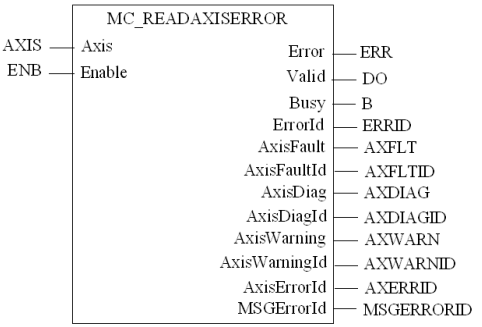
MC_READAXISERROR

Function Description

The MC_READAXISERROR function is used to recover system errors.

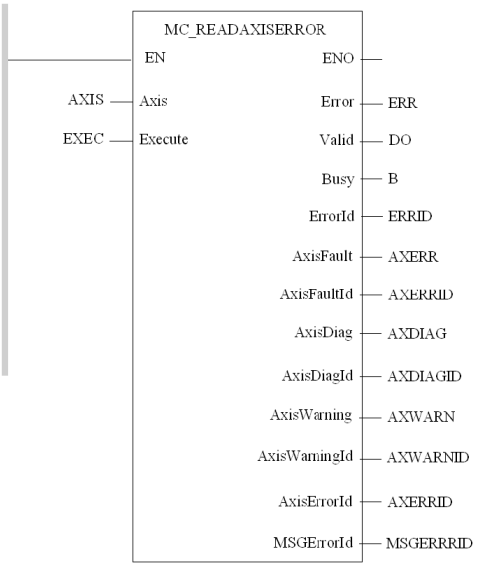
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_READAXISERROR(AXIS:=Axis, ENB:=Enable, ERR=>Error,
DO=>Valid, B=>Busy, ERRID=>ErrorId, AXFLT=>AxisFault,
AXFLTID=>AxisFaultId, AXDIAG=>AxisDiag, AXDIAGID=>AxisDiagId,
AXWARN=>AxisWarning, AXWARNID=>AxisWarningId,
AXERRID=>AxisErrorId, MSGERRORID=>MSGErrorId)
```

Representation in ST

Representation:

```
MC_READAXISERROR(AXIS:=Axis, ENB:=Enable, ERR=>Error,
DO=>Valid, B=>Busy, ERRID=>ErrorId, AXFLT=>AxisFault,
AXFLTID=>AxisFaultId, AXDIAG=>AxisDiag, AXDIAGID=>AxisDiagId,
AXWARN=>AxisWarning, AXWARNID=>AxisWarningId,
AXERRID=>AxisErrorId, MSGERRORID=>MSGErrorId);
```

Description of the Output Parameters

The following table describes the output parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
AxisFault	BOOL	Drive error.
AxisFaultId	UDINT	Drive error value.
AxisDiag	BOOL	Copy of the CPP110 diagnostic bit for the slave.
AxisDiagId	UINT	AxisDiag value.
AxisWarning	BOOL	Drive warning.
AxisWarningId	UINT	Drive warning value.
AxisErrorId	WORD	MFB error number latching.
MSGErrorId	UINT	Error latching by messaging.

Error Codes

The following table shows the list of diagnostic objects and the corresponding values according to the drive types:

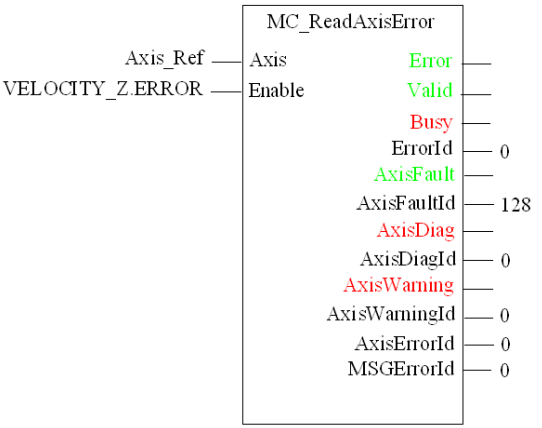
	ATV31	ATV71	Lexium 15MP/HP	Lexium 05 / Lexium 32	Icla	Lexium 15LP
AxisFaultId	LFT 2029:16	LFT 2029:16	ERRCODE 2070:16	SignLatched 301C:8	FaulSig_SR 301C:12	ERRCODE 385D:01
AxisWarningId	-	LRS6 2002:38	1002:00	WarnLatched 301C:0C	WarnSig 301C:A	1002:00
AxisDiagId	ERRD 603F:0	ERRD 603F:0	1003:01	StopFault 603F:0	StopFault 3020:7	1003:01

NOTE: Refer to the CANopen device documentation to identify themeaning of the code.

Special feature: The Lexium 15MP ERRCODE refers to the ASCII object documentation of the Lexium.

Diagnostic

The table below describes a procedure to diagnose the behavior following the execution of a MFB. The Lexium 15MP is the device used in this example.

Step	Action
1	The AxisFault output parameter equals 1. The AxisFaultId output parameter displays an error code value. The graph below shows how the diagnostic is given in this example through the code values: 

Step	Action
2	Refer to the ASCII object documentation of the Lexium 15MP, and look for the ASCII ERRCODE 2070:16.
3	In the ASCII documentation, the value 16#0080 (128 in decimal) for ERRCODE designates an overspeed.
4	Correct the speed constants.
5	Execute the `MC_Reset` block

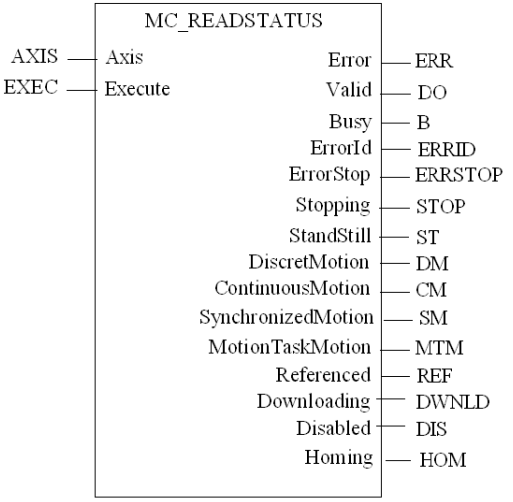
MC_READSTATUS

Function Description

The MC_READSTATUS function is used to determine the logical status of the servodrive *(see page 31)*.

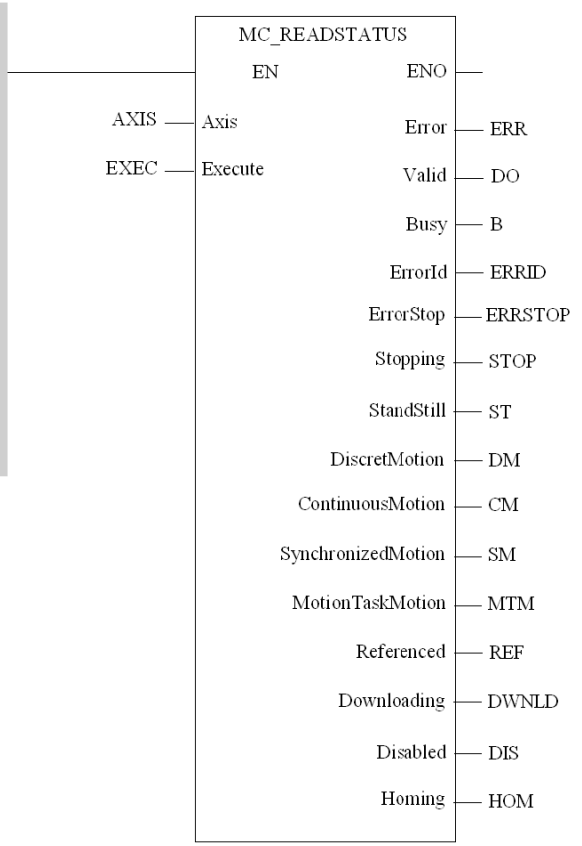
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_READSTATUS(AXIS:=Axis, EXEC:=Execute, ERR=>Error,
DO=>Valid, B=>Busy, ERRID=>ErrorId, ERRSTOP=>ErrorStop,
STOP=>Stopping, ST=>StandStill, DM=>DiscretMotion,
CM=>ContinuousMotion, SM=>SynchronizedMotion,
MTM=>MotionTaskMotion, REF=>Referenced, DWNLD=>Downloading,
DIS=>Disabled, HOM=>Homing)
```

Representation in ST

Representation:

```
MC_READSTATUS(AXIS:=Axis, EXEC:=Execute, ERR=>Error,
DO=>Valid, B=>Busy, ERRID=>ErrorId, ERRSTOP=>ErrorStop,
STOP=>Stopping, ST=>StandStill, DM=>DiscretMotion,
CM=>ContinuousMotion, SM=>SynchronizedMotion,
MTM=>MotionTaskMotion, REF=>Referenced, DWNLD=>Downloading,
DIS=>Disabled, HOM=>Homing);
```

Description of the Output Parameters

The following table describes the output parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
ErrorStop	BOOL	When ErrorStop is TRUE, stop with an error.
Stopping	BOOL	When Stopping is TRUE, MC_Stop is in progress.
StandStill	BOOL	When StandStill is TRUE, the servodrive is in StandStill status.
DiscretMotion	BOOL	When DiscretMotion is TRUE, a move in absolute or relative mode is in progress, or Jog.
ContinuousMotion	BOOL	When ContinuousMotion is TRUE, a move in speed mode is in progress, or Torque.
SynchronizedMotion	BOOL	A synchronization operation is in progress, via the gearing operating mode.
MotionTaskMotion	BOOL	An MotionTask operation is in progress via the Lxm_StartMtask block.
Referenced	BOOL	The servodrive is referenced (homing performed). **Note**: This bit is not taken into account for ATVx type servodrives.
Downloading	BOOL	When Downloading is TRUE, downloading is in progress.
Disabled	BOOL	Axis is in disable status.
Homing	BOOL	When Homing is TRUE: MC_HOME is in progress. Or for Lexium 05 / Icla MC_JOG going out of the LimitSwitches is in progress.

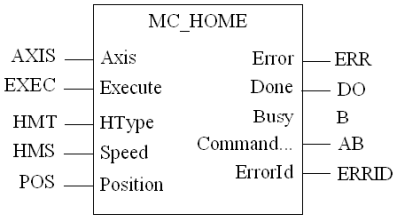
MC_HOME

Function Description

The MC_HOME function is used to execute a homing command.

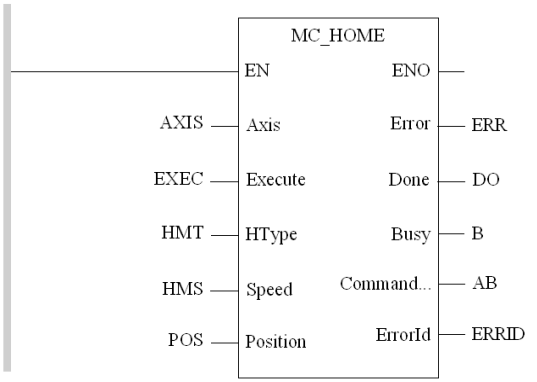
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL MC_HOME(AXIS:=Axis, EXEC:=Execute, HMT:=HType,
POS:=Position, HMS:=Speed, ERR=>Error, DO=>Done, B=>Busy,
AB=>CommandAborted, ERRID=>ErrorId)
```

Representation in ST

Representation:

```
MC_HOME(AXIS:=Axis, EXEC:=Execute, HMT:=HType, POS:=Position,
HMS:=Speed, ERR=>Error, DO=>Done, B=>Busy,
AB=>CommandAborted, ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
`HType`	`INT`	Homing type. For Lexium 15MP. `HType`: if the value is set to -1, no change, the parameter is not transmitted.
`Position`	`DINT`	Position at the end of the homing.
`Speed`	`DINT`	Homing speed. If the value is of 0, no change.

NOTE: The value of the homing type is described in the manual of the device to be implemented (for the Lexium 15, refer to the 'Lexium CANopen communication' and look for 'Homing').

LXM_GEARPOS

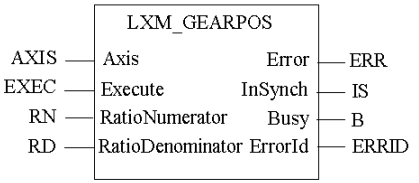
Function Description

The LXM_GEARPOS function is used to synchronize the position of a slave axis with a master axis, according to a coefficient (ratio).

NOTE: A physical connection to the auxiliary encoder command interface connector (X5) between the 2 servodrives must be present.

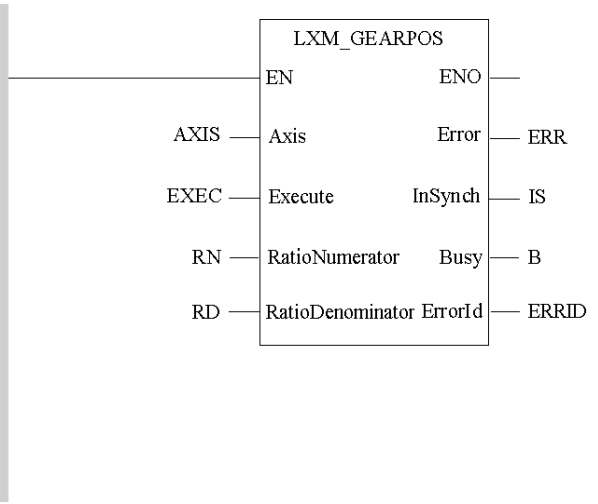
Representation in FBD

Representation



Representation in LD

Representation



Representation in IL

Representation:

```
LD Slave
CAL LXM_GEARPOS(AXIS:=Axis, EXEC:=Execute,
RN:=RatioNumerator, RD:=RatioDenominator, ERR=>Error,
IS=>InSynch, B=>Busy, ERRID=>ErrorId)
```

Representation in ST

Representation:

```
LXM_GEARPOS(AXIS:=Axis, EXEC:=Execute, RN:=RatioNumerator,
RD:=RatioDenominator, ERR=>Error, IS=>InSynch, B=>Busy,
ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
`Axis`	`AXIS_REF`	Axis_Ref *(see page 30)* type object, which defines the slave device.
`RatioNumerator`	`UINT`	Motion synchronization ratio numerator (allowed range 1-32767 for LXM05).
`RatioDenominator`	`UINT`	Motion synchronization ratio denominator.

Calcul of slave position for Lexium15MP

$$\Delta \text{ position slave} = \Delta \text{ position master x ratio numerator/ratio denominator}$$

Calcul of slave position for Lexium15LP

$$\Delta \text{ position slave} = \Delta \text{ position master x 1024 x ratio numerator/ratio denominator}$$

Description of the Output Parameters

The following table describes the output parameter that is in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
InSynch	BOOL	InSync is TRUE when the synchronization position, in relation to the Master, is reached. It remains TRUE as long as Execute is TRUE even if the axis has stopped. (not significant for Lexium 05/32).

Description parameter for the Lexium 05 and Lexium 32

The following table describes the additional parameter for the Lexium 05 and Lexium 32:

Parameter	Type	Comment
SyncMode	BOOL	SyncMode is an additional parameter for the Lexium 05/32.The access to this parameter by MC_ReadParameter or MC_WriteParameter before calling MFB_Gear, is possible by using: Index =0, Subindex=200 as object number for SyncMode. FALSE: immediate synchronization: the positioning controller follows reference pulses from the time at which the gear processing is activated. TRUE: synchronization with compensation movement. With activation of the gear processing, the motor endeavours to retrieve the reference pulses accumulated.

LXM_GearPosS

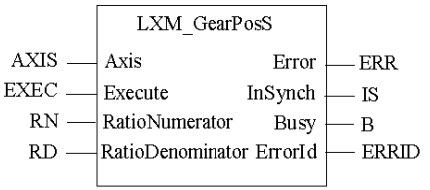
Function Description

Similar to LXM_GearPos, the function LXM_GearPosS is also used to synchronize the position of a slave axis with a master axis, according to a coefficient (ratio), but it allows to use and obtain negative values for the coefficient ratio.

NOTE: A physical connection to the auxiliary encoder command interface connector (X5) between the 2 servodrives must be present.

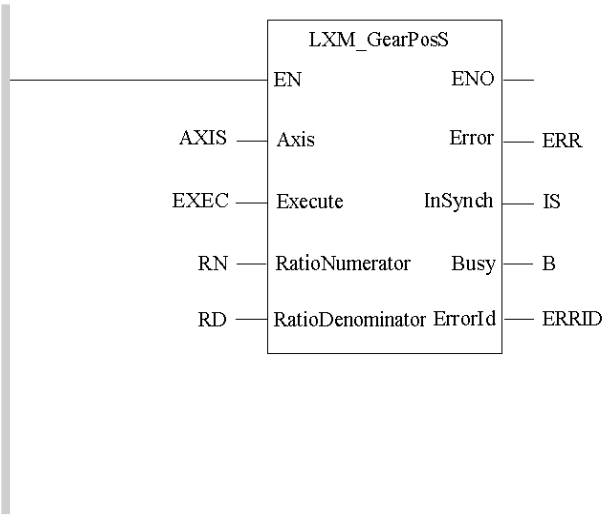
Representation in FBD

Representation



Representation in LD

Representation



Representation in IL

Representation:

```
LD Slave
CAL LXM_GearPosS(AXIS:=Axis, EXEC:=Execute,
RN:=RatioNumerator, RD:=RatioDenominator, ERR=>Error,
IS=>InSynch, B=>Busy, ERRID=>ErrorId)
```

Representation in ST

Representation:

```
LXM_GearPosS(AXIS:=Axis, EXEC:=Execute, RN:=RatioNumerator,
RD:=RatioDenominator, ERR=>Error, IS=>InSynch, B=>Busy,
ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
`Axis`	`AXIS_REF`	Axis_Ref *(see page 30)* type object, which defines the slave device.
`RatioNumerator`	`INT`	Motion synchronization ratio numerator.
`RatioDenominator`	`INT`	Motion synchronization ratio denominator.

Allowed values	Lexium 15MP/HP	Lexium 05/32	Lexium 15LP
`Range for RatioNumerator`	-32768,32767	-32768,32767.	1,32767.
`Range for RatioDenominator`	1,32767	1,32767.	-32768,32767.

For Lexium 15LP/MP

- The value 0 means “the value does not change” and so the parameter inside the drive is not updated
- When one of inputs value is out of range, the block goes on error with the already existing error code value 8: AXIS_COMMAND_REFUSED

Calcul of slave position for
Lexium15MP

$$\Delta \text{ position slave} = \Delta \text{ position master x ratio numerator/ratio denominator}$$

Calcul of slave position for
Lexium15LP

$$\Delta \text{ position slave} = \Delta \text{ position master x } 1024 \text{ x ratio numerator/ratio denominator}$$

Description of the Output Parameters

The following table describes the output parameter that is in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
InSynch	BOOL	InSync is TRUE when the synchronization position, in relation to the Master, is reached. It remains TRUE as long as Execute is TRUE even if the axis has stopped. (not significant for Lexium 05/32).

Description parameter for the Lexium 05 and Lexium 32

The following table describes the additional parameter for the Lexium 05 and Lexium 32:

Parameter	Type	Comment
SyncMode	BOOL	SyncMode is an additional parameter for the Lexium 05/32.The access to this parameter by MC_ReadParameter or MC_WriteParameter before calling MFB_Gear, is possible by using: Index =0, Subindex=200 as object number for SyncMode. FALSE: immediate synchronization: the positioning controller follows reference pulses from the time at which the gear processing is activated. TRUE: synchronization with compensation movement. With activation of the gear processing, the motor endeavours to retrieve the reference pulses accumulated.

TE_UPLOADDRIVEPARAM

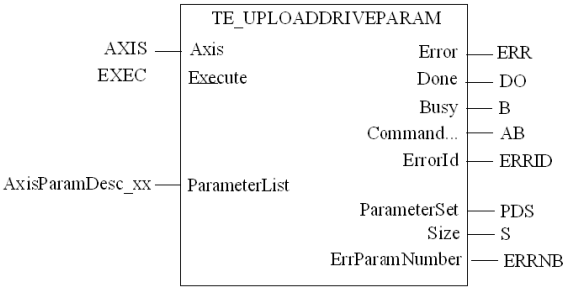
Function Description

The TE_UPLOADDRIVEPARAM function is used to save the parameters of one servodrive to a memory zone of a PLC.

NOTE: Before executing this function, the servodrive status must be Disabled *(see page 31)*.

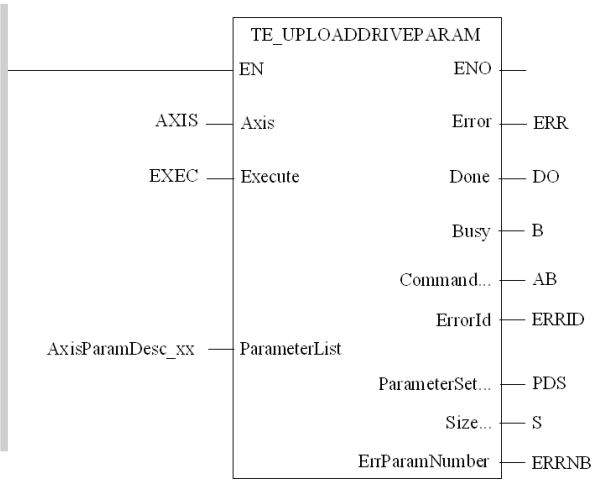
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL TE_UPLOADDRIVEPARAM(AXIS:=Axis, EXEC:=Execute,
AxisParamDesc_xx:=ParameterList, ERR=>Error, DO=>Done,
B=>Busy, AB=>CommandAborted, ERRID=>ErrorId,
PDS:=ParameterSet, S=>Size, ERRNB=>ErrParamNumber)
```

Representation in ST

Representation:

```
CAL TE_UPLOADDRIVEPARAM(AXIS:=Axis, EXEC:=Execute,
AxisParamDesc_xx:=ParameterList, ERR=>Error, DO=>Done,
B=>Busy, AB=>CommandAborted, ERRID=>ErrorId,
PDS:=ParameterSet, S=>Size, ERRNB=>ErrParamNumber)
```

Description of the Input Parameters

The following table describes the input parameter that is in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
ParameterList	ANY_ARRAY_UINT	List of parameters: address and length. ParameterList is to be assigned to the corresponding array created by the MTM

NOTE: `ParameterList` is to be assigned to the `ParamDesc` variable taken from the configuration of the axis **recipe** in the *Movement* directory.

Description of the Output Parameters

The following table describes the output parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
ParameterSet	ANY_ARRAY_BYTE	Parameter buffer. ParameterSet is to be assigned to the corresponding array created by the MTM
Size	UINT	`ParameterSet` size in bytes.
ErrParamNumber	UDINT	Faulty index and sub-index numbers.

NOTE: `ParameterSet` can be assigned to the `Recipe` variable if there is only one **recipe** declared for the axis.

TE_DOWNLOADDRIVEPARAM

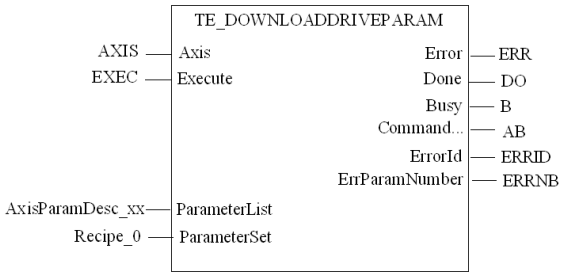
Function Description

The `TE_DOWNLOADDRIVEPARAM` function is used to transfer the parameters of a servodrive that have been saved previously in the servodrive's PLC memory zone (for a change of production or for the replacement of a defective servodrive).

NOTE: Before executing this function, the servodrive status must be Disabled *(see page 31)*.

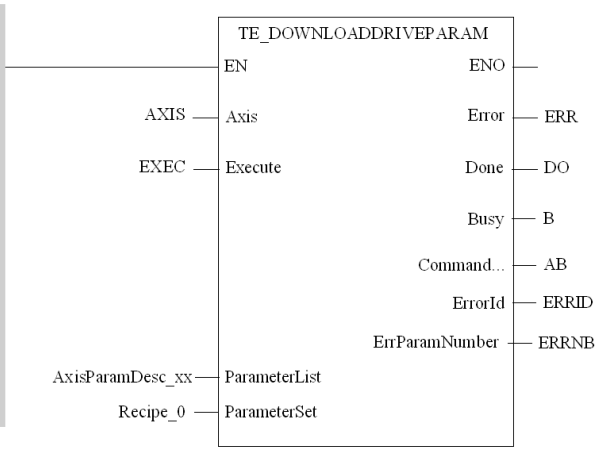
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL TE_DOWNLOADDRIVEPARAM(AXIS:=Axis, EXEC:=Execute,
AxisParamDesc_xx:=ParameterList, PS=>ParameterSet,
ERR=>Error, DO=>Done, B=>Busy, AB=>CommandAborted,
ERRID=>ErrorId,  ERRNB=>ErrParamNumber)
```

Representation in ST

Representation:

```
TE_DOWNLOADDRIVEPARAM(AXIS:=Axis, EXEC:=Execute,
AxisParamDesc_xx:=ParameterList, PS=>ParameterSet,
ERR=>Error, DO=>Done, B=>Busy, AB=>CommandAborted,
ERRID=>ErrorId, ERRNB=>ErrParamNumber);
```

Description of the Input Parameters

The following table describes the input parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
ParameterList	ANY_ARRAY_UINT	List of parameters: address and length. ParameterList is to be assigned to the corresponding array created by the MTM.
ParameterSet	ANY_ARRAY_BYTE	Parameter buffer. ParameterSet is to be assigned to the corresponding array created by the MTM

Description of the Output Parameters

The following table describes the output parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
ErrParamNumber	UDINT	Faulty index and sub-index numbers.

LXM_UPLOADMTASK

Function Description

MotionTasks are created by a UniLink (by GMT) and saved directly to the EEPROM memory of the Lexium 15MP/LP/HP.

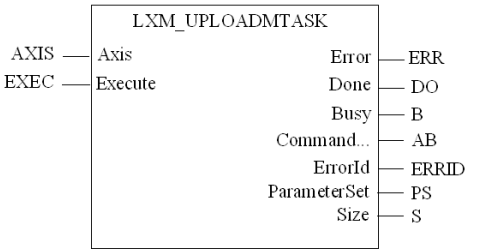
The LXM_UPLOADMTASK function is used to save the MotionTask parameters of the servodrive to a PLC memory zone.

This function is applicable on the Lexium 15MP/LP/HP servodrive only.

NOTE: Before executing this function, the servodrive status must be Disabled *(see page 31)*.

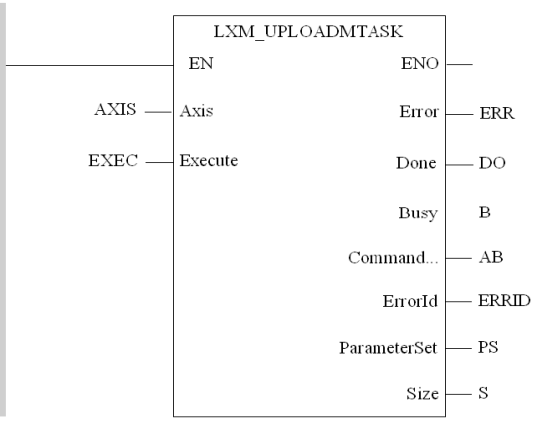
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL LXM_UPLOADMTASK(AXIS:=Axis, EXEC:=Execute, ERR=>Error,
DO=>Done, B=>Busy, AB=>CommandAborted, ERRID=>ErrorId,
PS:=ParameterSet, S=>Size)
```

Representation in ST

Representation:

```
LXM_UPLOADMTASK(AXIS:=Axis, EXEC:=Execute, ERR=>Error,
DO=>Done, B=>Busy, AB=>CommandAborted, ERRID=>ErrorId,
PS:=ParameterSet, S=>Size);
```

Description of the Output Parameters

The following table describes the output parameters that are in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
`ParameterSet`	`ANY_ARRAY_BYTE`	The byte table where the Motion Tasks are saved (DDT structure). This table depends on the number of Motion Function Block (used in the project. For Lexium 17/15MP the byte table is equal to : 12 + 27 MT number x bytes For Lexium 15LP the byte table is equal to: 12 + 29 MT number x bytes MT : Motion Task
`Size`	`UINT`	Size of the byte table corresponding to the `ParameterSet` parameter.

LXM_DOWNLOADMTASK

Function Description

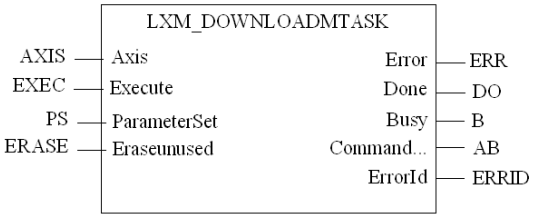
The LXM_DOWNLOADMTASK function is used to load a motion task from the memory of the PLC to the servodrive.

This function is applicable on the Lexium 15 servodrive only.

NOTE: before executing this function, the servodrive status must be Disabled *(see page 31)*.

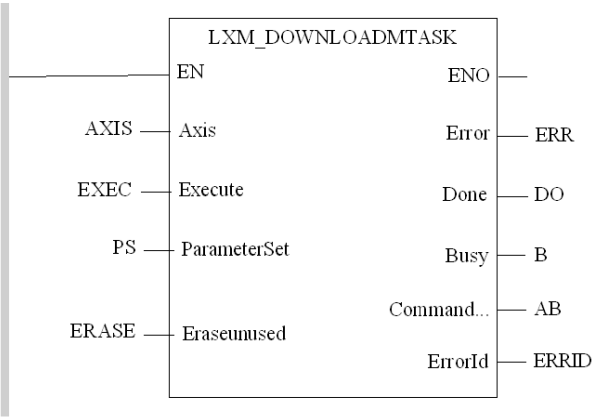
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL LXM_DOWNLOADMTASK(AXIS:=Axis, EXEC:=Execute,
PS:=ParameterSet, ERASE:=Eraseunused, ERR=>Error, DO=>Done,
B=>Busy, AB=>CommandAborted, ERRID=>ErrorId)
```

Representation in ST

Representation:

```
LXM_DOWNLOADMTASK(AXIS:=Axis, EXEC:=Execute,
PS:=ParameterSet, ERASE:=Eraseunused, ERR=>Error, DO=>Done,
B=>Busy, AB=>CommandAborted, ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameter that is in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
ParameterSet	ANY_ARRAY_BYTE	Motion tasks value (DDT structure).
Eraseunused	BOOL	Erases unused tasks.

LXM_STARTMTASK

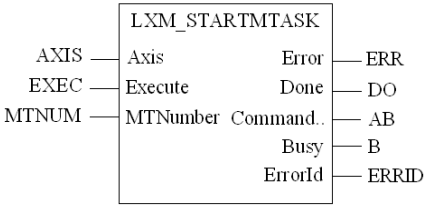
Function Description

The `LXM_STARTMTASK` function is used to launch the execution of the Motion Task for Lexium 15 whose number matches the value entered in the `MTNumber` input parameter.

The `LXM_STARTMTASK` function can also be used to launch the execution of the MotionSequence for Lexium 32.

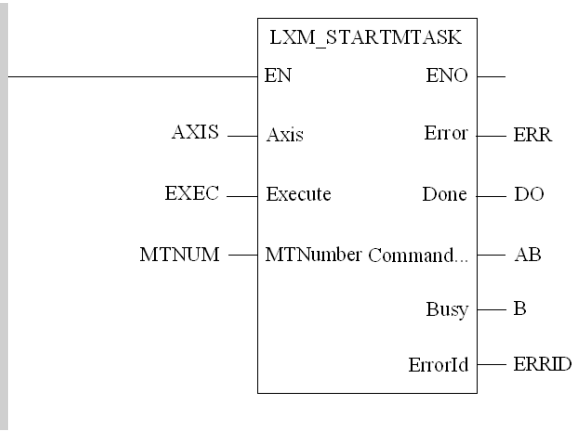
Representation in FBD

Representation:



Representation in LD

Representation:



Representation in IL

Representation:

```
LD Axis
CAL LXM_STARTMTASK(AXIS:=Axis, EXEC:=Execute,
MTNUM:=MTNumber, ERR=>Error, DO=>Done, AB=>CommandAborted,
B=>Busy, ERRID=>ErrorId)
```

Representation in ST

Representation:

```
LXM_STARTMTASK(AXIS:=Axis, EXEC:=Execute, MTNUM:=MTNumber,
ERR=>Error, DO=>Done, AB=>CommandAborted, B=>Busy,
ERRID=>ErrorId);
```

Description of the Input Parameters

The following table describes the input parameter that is in addition to the basic *(see page 35)* parameters:

Parameter	Type	Comment
MTNumber	INT	Motion Task or MotionSequence number.

Units and Servodrives

Units

The following table shows you the speed, position and direction units by servodrive:

Units	Lexium15MP/HP/LP	Icla	ATV31	ATV71	Lexium05 / Lexium32
Position	PUNIT	inc	-	-	USR
Speed	VUNIT	rpm	rpm	rpm	rpm
Rotation	rpm	rpm	rpm	rpm	rpm
Torque	1/1000 rated torque	-	0.01 nominal torque	0.01 nominal torque	1/100 amp

USR is a unit that the user defines in Powersuite (by default, it is 16,384 units per rev).

PUNIT is a position unit that the user defines in Unilink.

VUNIT is a unit to be defined by Unilink (by default, this is PUNIT/sec).

NOTE: Rotation units only concern the `MC_MOVEVELOCITY` block.

Speed Equation of the Lexium 15 MP/HP in Speed Mode

The rotation speed of the motor controlled in speed mode by a Lexium 15MP is the setpoint speed multiplied by 0.5722 ($0.5722=60*10000/2^{20}$).

Example:

The value of the `VELOCITY` input parameter of the `MC_MOVEVELOCITY` block is 3000. The gearing rotation speed is therefore 1716.6 RPM (3000*0.5722).

Speed Equation of the Lexium 15 MP/HP in Position Mode

The rotation speed of an axis controlled in position mode by a Lexium 15MP is the setpoint speed multiplied by a coefficient K.

K=PGearI/10000.

PGearI is the numerator of the resolution configured in the servodrive by Unilink.

Example:

The value of the `VELOCITY` input parameter of the `MC_MOVEABSOLUTE` block is 3000. PGearI is 5000. Punit is in µm format.

K=5000/10000=0.5

Thus the axis speed is 15000 µm/sec (30000*0.5).

Speed Equation of the Lexium 15 LP in Position Mode and Speed Mode

The new MFB library available on Unity Pro V3.0, accepts the new Lexium 15 drives range compatible on the M340 and PREMIUM PLC platform

Parameter VELOCITY equation of the Lexium 15 LP in Position mode for MC_MOVEABSOLUTE and MC_MOVERELATIVE :

VELOCITY (rpm) = VELOCITY (inc/250 µs) * (60*4000) / 2 ^ 32

Parameter VELOCITY equation of the Lexium 15 LP in a Velocity mode for MC_MOVEVELOCITY:

VELOCITY (rpm) = VELOCITY * 60 / P_GEARI

Unit of the status velocity of the Lexium 15 LP for MC_READACTUALVELOCITY:

PUNIT (Basic screen in Unilink) defines VELOCITY unit

Unit of the Position parameter and status of the Lexium 15 LP

VUNIT (Basic screen in Unilink) defines Position unit

We strongly advise the use of the speed units in rpm whatever the type of control is. In the other cases of units (i.e. mm/min) the formulas are to be adapted to take into account the linear dimension of the unit and no more the angular one, by integrating the P_GEARI factor there.

Tab synthesys => VELOCITY unit in rpm position mode using MC_MOVEABSOLUTE command for example:

VELOCITY Setpoint in rpm. Reading on Unilink in rpm

VELOCITY value returned by MC_READACTUALVELOCITY:

VELOCITY (inc/250 µs) = VELOCITY Setpoint (rpm) * 2 ^ 32 / (60 x 4000)

In velocity mode, using MC_MOVEVELOCITYcommand

VELOCITY Setpoint to be applied related to the velocity in rpm to be reached. Reading on Unilink in rpm

VELOCITY Setpoint = VELOCITY (rpm) * P_GEARI / 60

VELOCITY value returned by MC_READACTUALVELOCITY:

VELOCITY = VELOCITY Setpoint * 2 ^ 32 / (P_GEARI x 4000)

Messaging Service

Introduction

The blocks that use messaging slow down the PLC's cycle time because they make `READ_VAR` and `WRITE_VAR` type requests to the servodrive.

Motion Function Block

The below table shows you which blocks use the messaging service, by type of servodrive:

Block name	Lexium 15MP/HP	Icla	ATV31	ATV71	Lexium05 / Lexium32	Lexium15 LP
MC Jog	W2024:7	W:3029:4 W:3029:5 W:3029:7 W:3029:8	NA	NA	W:3029:4 W:3029:5 W:3029:7 W:3029:8	NA
MC_ReadActualPosition	-	R position	-	-	-	-
MC_ReadActualTorque	-	NA	R:2002:6	R:6077	R:301E:3	R:6077
MC_ReadActualVelocity	-	R velocity	-	-	-	-
MC_Stop	R Stopstate	-	R Stopstate	R Stopstate	X	R Stopstate
MC_TorqueControl	W:2060	NA	NA	W:6071 R:2002:39	no SDO	W:6071
MC_MoveAbsolute MC_MoveRelative MC_MoveAdditive	W ACC 6083:0 W DEC 6084:0	W ACC 301D:1A	-	-	W ACC 6083:0 W DEC 6084:0	W ACC 6083:0 W DEC 6084:0
MC_ReadAxisError	R 2070:16 R 1002:0 R 1003:1	R 301C:12 R 301C:A R 3020:7	R 2029:16 R 603F:0	R 2029:16 R 603F:0	R 301C:8 R 301C:C R 603F:0	R 385D:1 R 1002:0 R 1003:1
MC_Home	W Hposition 607C:0 W Hspeed 6099:1 W HType 6098:0	W Hposition 3028:B W Hspeed 3028:4	-	-	W Hposition 3028:B W Hspeed 6099:1	W Hposition 607C:0 W Hspeed 6099:1 W HType 6098:0

Block name	Lexium 15MP/HP	Icla	ATV31	ATV71	Lexium05 / Lexium32	Lexium15 LP
Lxm_GearPos Lxm_GearPosS	W GearI 3540:1 W GearO 353E:1	NA	NA	NA	no SDO	W:3540:1 W353E:1
Lxm_DownloadMTask	Equationf(MT)	-	-	-	-	Equationf(MT)
Lxm_UploadMTask	Equationf(MT)	-	-	-	-	Equationf(MT)
Lxm_StartMTask	Task number	-	-	-	-	Task number
Notes	R: Use of READ_VAR messaging service W: Use of WRITE_VAR messaging service R 2029:16: Read an SDO-type object with index 2029 and sub-index 16.					

Memory size

Memory size of the axis declaration

The amount of memory used during one `AXIS_REF` axis declaration in the **Motion** directory without a recipe is 240 bytes.

Memory size of the recipe

The table below shows the memory size (in word) used by one or more recipe.

Device	Size used by the first recipe	Size used by the following recipe, with drive firmware current version	Size used by the following recipe, with drive firmware previous version
Lexium 15LP	1435	577	664
Lexium 15MP/HP	1268	510	
Lexium 32	1428	394	
ATV31	646	167	170
ATV71	1726	437	499
Lexium 05	314	96	133
Icla Ifa	303	99	
Icla Ife	244	82	
Icla Ifs	230	77	

Memory size of MFB blocks for Premium platform

The table below shows on the Premium the memory size (in bytes) used by code, data by instance and by upload information in the MFB blocks.

MFB block type	data by instance	code
CAN_HANDLER	336	15229
Lxm_DownloadMTask	112	3248
Lxm_GearPosS	112	3360
Lxm_GearPos	112	3296
Lxm_StartMTask	96	2528
Lxm_UploadMTask	96	2288
MC_TorqueControl	144	4336
MC_Home	112	4686
MC_Jog	192	6784
MC_MoveAbsolute	144	4752

MFB block type	data by instance	code
MC_MoveAdditive	144	3376
MC_MoveRelative	144	4096
MC_MoveVelocity	128	3424
MC_Power	80	1232
MC_ReadActualPosition	80	944
MC_ReadActualTorque	96	1110
MC_ReadActualVelocity	96	976
MC_ReadAxisError	96	2048
MC_ReadParameter	96	1104
MC_ReadStatus	80	832
MC_Reset	80	2592
MC_Stop	128	3360
MC_WriteParameter	96	1248
TE_DownloadDriveParam	176	5792
TE_UploadDriveParam	160	2352

NOTE: On Premium Legacy PLC's (TSX571x4, TSX572x4, TSX573x4), the maxium code size for all EFB of the same family is limited to 64K byte. You must check the code size used by MFB in your application, to ensure that it does not involve a code size greater than 64K byte (otherwise it will not be possible to generate the application).

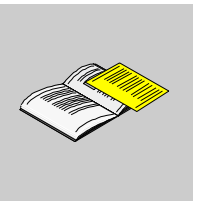
Memory size of MFB blocks for Modicon M340 platform

The table below shows on the Modicon M340 the memory size (in bytes) used by code, data by instance and by upload information in the MFB blocks.

MFB block type	data by instance	code
Axis_ref	248	
CAN_HANDLER	352	18992
Lxm_DownloadMTask	128	3032
Lxm_GearPos	128	3632
Lxm_GearPosS	128	3840
Lxm_UploadMTask	110	2480
Lxm_StartMTask	86	2832
MC_TorqueControl	148	4816
MC_Home	136	4688
MC_Jog	160	7984

MFB block type	data by instance	code
MC_MoveAbsolute	154	5056
MC_MoveAdditif	146	3552
MC_MoveRelatif	154	4320
MC_MoveVelocity	144	3888
MC_Power	78	1408
MC_ReadActualPosition	100	880
MC_ReadActualTorque	98	1264
MC_ReadActualVelocity	100	912
MC_ReadAxisError	116	2160
MC_ReadParameter	102	1216
MC_ReadStatus	89	912
MC_Reset	80	2624
MC_Stop	143	3296
MC_WriteParameter	104	1216
TE_DownloadDriveParam	176	7184
TE_UploadDriveParam	176	2240

Appendices



Overview

This section contains the appendicies.

What's in this Appendix?

The appendix contains the following chapters:

Chapter	Chapter Name	Page
A	Error Codes and Values	105
B	MFB performances	109

Error Codes and Values

A

Tables of Error Codes for the Motion Function Block Library

Introduction

The tables presented in this section list the error codes and values generated by the blocks in the MotionFunctionBlock library.

Motion Function Blocks

The following table contains the error codes and values generated in the `ErrorId` output parameter of MFB blocks.

Error_Id (decimal format)	Meaning
0	Correct execution.
1	Premium and Atrium PLC messaging *(see Unity Pro, Communication, Block Library)* or M340 PLC messaging *(see Modicon M340 with Unity Pro, CANopen, User manual)* system deferred error, to see details use MC_ReadAxisError *(see page 71)* block with the `MSGERRORID` information.
2	-
3	The block was interrupted due to a power cut.
4	Cancelled block (`Enable` switched to 0 during execution).
5	-
6	Faulty axis or axis missing.
7	`Axisref` changed value during execution of block or the same instance programmed with another `Axis_Ref`. If the value belongs to the `Can_Handler` block, the `Axis_Ref` is not intended for the `CAN_Handler` variable.
8	The servodrive has rejected the command (to see details, use `MC_ReadAxisError` block).
9	This block cannot be executed in this axis mode (axis mode available using `MC_ReadStatus`).

Error_Id (decimal format)	Meaning
10	Bad condition for jog direction: Both forward and backward inputs are active. If the axis was moving, it will be stopped.
11	The block was interrupted by a MC_Stop.
12	The block was interrupted by another block (for example: one MC_MOVE interrupting another).
13	The block has stopped because the servodrive has taken too long to perform the command (e.g.: MC_POWER).
14	The servodrive should be enabled but it is not now.
15	-
16	-
17	During an implicit exchange with the servodrive, the block has either: • lost the semaphore because a priority block took it, • or the block has not been invoked for n cycles, the system has therefore withdrawn the semaphore.
18	Unable to execute the MFB.
19	During an implicit exchange with the servodrive, the semaphore could not be obtained in the time allowed (too many blocks waiting for the servodrive, or servodrive too slow to react).
20	Internal error.
21	Parameter transfer error (corrupted data); TE_UpLoadDriveParam and TE_DownLoadDriveParam blocks.
22	During an implicit messaging exchange with the servodrive, the block has either: • lost the semaphore because a priority block took it, • or the block has not been invoked for n cycles, the system has therefore withdrawn the semaphore.
23	Internal error.
24	During a messaging exchange with the servodrive, the PLC's messaging system was saturated for more than five PLC cycles.
25	Internal error.
26	The AMT has configured a servodrive that the MFB cannot program.
27	PLC messaging *(see Unity Pro, Communication, Block Library)* system immediate error, see details using MC_ReadAxisError *(see page 71)* block with the MSGERRORID information.
28	Axis programmed in two CAN_HANDLERs.
29	InitAxis: No network at the programmed network address.
30	-
31	Internal error.

Error_Id (decimal format)	Meaning
32	Temporary error sent back by MC_Readstatus during a warm restart.
33	SET variable is too small for the data to write.
34	SET variable is incompatible with this servodrive.
35	LIST variable is incompatible with this servodrive.
36	LIST variable corrupted (checksum error).
37	SET variable corrupted (checksum error).
38	Restarting of Can_handler
39	The **TSX CPP 110** card does not see the device at the configured address.
40	The family in the configuration does not match the one in the current servodrive.
41	The reference in the configuration does not match the one in the current servodrive.
42	Servodrive unknown.
43	The parameters List version does not match the Set version set of parameters.
44	The servodrive is still faulty after a reset.
45	The device does not work correctly when the MFB command is performed (only for Lexium 17).

MFB performances

B

MFB Performance Table

At a glance

The table below presents for the differents tests with Motion Function Block the performances for each servodrive.

Conditions and rules

CANopen baud rate configuration = 500kbds

PLC period task is :

- 5ms+ nb_axis_x1ms if nb_axis>3,
- 5ms if nb_axis<=3.

Test table

The test are done for the following servodrives: Lexium 05 / Lexium 32, Lexium 15 MP/HP, Lexium 15 LP, Icla, ATV31 and ATV71.

	Performances (ms)					
Test Type	**Lexium 05 / Lexium 32**	**Lexium 15 MP/HP**	**Lexium 15 LP**	**Icla**	**ATV31**	**ATV71**
`MC_MOVEABSOLUTE` Start (change mode, modification of acceleration and deceleration)	(6 to 7)c	(6 to 7)c	(6 to 7)c	(4 to 5)c	X	X
`MC_MOVEABSOLUTE` Start (no changes)	1c	1c	1c	1c	X	X
Time between 2 `MC_MOVEABSOLUTE` (1)	2c	2c + 3ms + TcMH	2c + 1ms + TcLP	2c	X	X
Time between 2 `MC_MOVEABSOLUTE` (second motion task just after the first motion task)	1c + 0.5 ms	1c + 3ms + TcMH	1c + 1ms + TcLP	1c + 0.5 ms	X	X

	Performances (ms)					
Test Type	**Lexium 05 / Lexium 32**	**Lexium 15 MP/HP**	**Lexium 15 LP**	**Icla**	**ATV31**	**ATV71**
Interruption delay `MC_MOVEABSOLUTE` to the same instance	1c + 0.5 ms	1c + 5ms + TcMH	1c + 1ms + TcLP	1c + 0.5 ms	X	X
Interruption delay `MC_MOVEABSOLUTE` with another instance	1c + 0.5 ms	1c + 5ms + TcMH	1c + 1ms + TcLP	1c + 0.5 ms	X	X
Start motion task	X	1c + 5ms + TcMH	1c + 2ms + TcLP	X	X	X
Delay between two motion tasks (1)	X	1c + 5ms + TcMH	42 + TcLP	X	X	X
Stop during Move	1c + 0.5 ms	1c + 1ms + TcMH	1c + 2ms + TcLP	1c + 0.5 ms	X	X
Change speed in the same instance of `MC_MOVEVELOCITY`	1c + 0.5 ms	1c + 1ms + TcMH	1c + 1ms + TcLP	1c + 0.5 ms	1c + 10ms + TcATV31	1c + 5ms + TcATV71
Save servodrives parameters (`TE_UPLOADDRIVEPARAM`)	212	760	851	197	473	1283
Transfer of servodrives parameters (`TE_DOWNLOADDRIVEPARAM`)	219	1239	1460	204	502	1329
Save 20 motion tasks (`LXM_UPLOADMTASK`)	X	1778	1739	X	X	X
Load 20 motion tasks (`LXM_DOWNLOADMTASK`)	X	1237	583	X	X	X

Legend

(1): in the case of a program where the second comand comes before the first command, you have to add one PLC period task on the equation.
c: PLC period task
TcMH: Lexium 15 MP/HP cycle time (0 to 3 ms)
TcLP: Lexium 15 LP cycle time (0 to 1 ms)
TcATV31: ATV31 cycle time (15 ms)
TcATV71: ATV71 cycle time (5 ms)

Examples

Applications with 3 axis (Lexium 05):

c = 5 ms

Time start a MC_MOVEABSOLUTE with no changes = 1c = 5ms

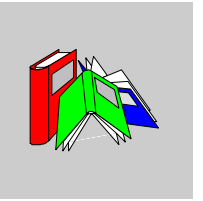
Interruption delay of the same instance of MC_MOVEABSOLUTE = 1c+0,5ms = 5+0,5 = 5,5ms

Applications with 1 axis (Lexium 15LP):

c = 5 ms

Time start a MC_MOVEABSOLUTE with changes = 6c +1c = 6x5+5 = 35ms

Glossary



0-9

%I

According to the CEI standard, %I indicates a language object of type discrete IN.

%IW

According to the CEI standard, %IW indicates a language object of type analog IN.

%KW

According to the CEI standard, %KW indicates a language object of type constant word.

%M

According to the CEI standard, %M indicates a language object of type memory bit.

%MW

According to the CEI standard, %MW indicates a language object of type memory word.

%Q

According to the CEI standard, %Q indicates a language object of type discrete OUT.

%QW

According to the CEI standard, %QW indicates a language object of type analog OUT.

A

ADDM_TYPE

This predefined type is used as an output for the ADDM function. This is an ARRAY[0..8] OF Int. You can find it in the library, in the same family as the EFs that use it.

ADDR_TYPE

This predefined type is used as an output for the ADDR function. This is an ARRAY[0..5] OF Int. You can find it in the library, in the same family as the EFs that use it.

ANL_IN

`ANL_IN` is the abbreviation of the analog input data type. It is used when processing analog values. `%IW` addresses in the configured analog input module, which are specified in the list of I/O components, are automatically assigned to data types, and therefore must be occupied by unassigned variables only.

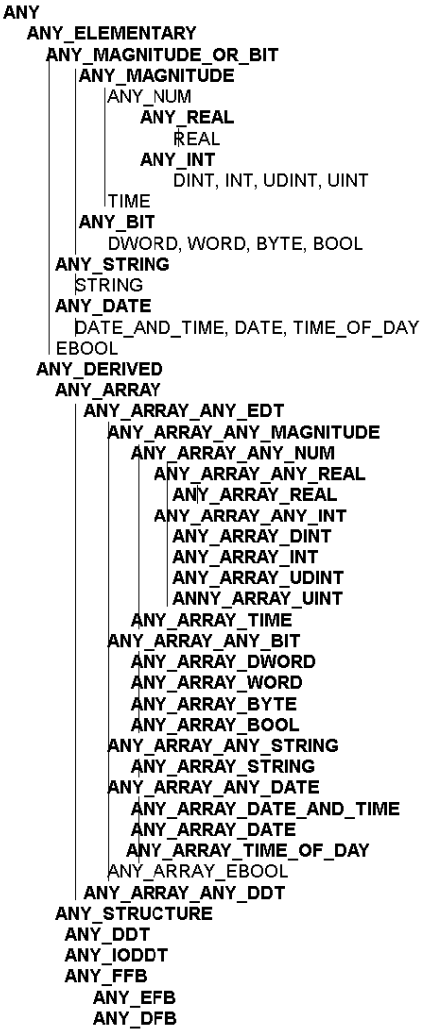
ANL_OUT

`ANL_OUT` is the abbreviation of the analog output data type. It is used when processing analog values. `%MW` addresses in the configured analog input module, which are specified in the list of I/O components, are automatically assigned to data types, and therefore must be occupied by unassigned variables only.

ANY

There is a hierarchy among the various data types. In the DFBs, it is sometimes possible to declare variables that can contain several types of values. In that case we use `ANY_xxx` types.

The figure below describes this hierarchical structure:



ARRAY

An ARRAY is a table containing elements of a single type.

The syntax is as follows: ARRAY [<limits>] OF <Type>

Example:

ARRAY [1..2] OF BOOL is a one-dimensional table with two elements of type BOOL.

ARRAY [1..10, 1..20] OF INT is a two-dimensional table with 10x20 elements of type INT.

Assigned variables

A variable whose position in the PLC memory can be known. For example, the Water_pressure variable is associated with %MW102. Water_pressure is said to be assigned.

B

BCD

BCD is the abbreviation of the Binary Coded Decimal format.

BCD can be used to represent decimal numbers between 0 and 9 using a set of four bits (nybble).

In this format, the four bits used to encode decimal numbers have an unused range of combinations.

Example of BCD encoding:
- The number 2,450
- is encoded: 0010 0100 0101 0000

BOOL

BOOL is the abbreviation for the Boolean type. This is the basic data type in computing. A BOOL variable can have either of the following two values: 0 (FALSE) or 1 (TRUE).

A bit extracted from a word is of type BOOL, for example: %MW10.4.

BYTE

When 8 bits are grouped together, they are called a BYTE. You can enter a BYTE either in binary mode or in base 8.

The BYTE type is encoded in an 8 bit format which, in hexadecimal format, ranges from 16#00 to 16#FF.

D

DATE

The DATE type, encoded in BCD in a 32 bit format, contains the following information:

- the year encoded in a 16 bit field;
- the month encoded in an 8 bit field;
- the day encoded in an 8 bit field.

The DATE type must be entered as follows: **D#**<Year>**-**<Month>**-**<Day>

This table shows the upper/lower limits of each field:

Field	Limits	Comment
Year	[1990,2099]	Year
Month	[01,12]	The leading 0 is displayed; it can be omitted during data entry.
Day	[01,31]	For months 01/03/05/07/08/10/12
	[01,30]	For months 04/06/09/11
	[01,29]	For month 02 (leap years)
	[01,28]	For month 02 (non-leap years)

DATE_AND_TIME

See DT.

DBCD

Representation of a double integer in double BCD format.

BCD format can be used to represent decimal numbers between 0 and 9 using a set of four bits.

In this format, the four bits used to encode decimal numbers have an unused range of combinations.

Example of DBCD encoding:
- The number 78,993,016
- is encoded: 0111 1000 1001 1001 0011 0000 0001 0110

DDT

DDT is the abbreviation of Derived Data Type.

A derived data type is a set of elements with the same type (ARRAY) or with different types (structure).

DFB

DFB is the abbreviation of Derived Function Block.

DFB types are function blocks that can be defined by the user in ST, IL, LD or FBD language.

Using these DFB types in an application makes it possible to:

- simplify the design and entry of the program;
- make the program easier to read;
- make it easier to debug;
- reduce the amount of code generated.

DINT

DINT is the abbreviation of Double INTeger (encoded in 32 bits).

The upper/lower limits are as follows: -(2 to the power of 31) to (2 to the power of 31) - 1.

Example:

-2147483648, 2147483647, 16#FFFFFFFF.

DT

DT is the abbreviation of Date and Time.

The DT type, encoded in BCD in a 64 bit format, contains the following information:

- the year encoded in a 16 bit field;
- the month encoded in an 8 bit field;
- the day encoded in an 8 bit field;
- the time encoded in an 8 bit field;
- the minutes encoded in an 8 bit field;
- the seconds encoded in an 8 bit field.

NOTE: The 8 least significant bits are not used.

The DT type must be entered as follows:

DT#<Year>**-**<Month>**-**<Day>**-**<Hour>**:**<Minutes>**:**<Seconds>

This table shows the upper/lower limits of each field:

Field	Limits	Comment
Year	[1990,2099]	Year
Month	[01,12]	The leading 0 is displayed; it can be omitted during data entry.
Day	[01,31]	For months 01/03/05/07/08/10/12
	[01,30]	For months 04/06/09/11
	[01,29]	For month 02 (leap years)
	[01,28]	For month 02 (non-leap years)
Hour	[00,23]	The leading 0 is displayed; it can be omitted during data entry.
Minute	[00,59]	The leading 0 is displayed; it can be omitted during data entry.
Second	[00,59]	The leading 0 is displayed; it can be omitted during data entry.

DWORD

`DWORD` is the abbreviation of Double Word.

The `DWORD` type is encoded in a 32 bit format.

This table shows the upper/lower limits of each of the bases that can be used:

Base	Lower limit	Upper limit
Hexadecimal	16#0	16#FFFFFFFF
Octal	8#0	8#37777777777
Binary	2#0	2#11111111111111111111111111111111

Examples of representation:

Data	Representation in one of the bases
00000000000010101101110011011110	16#ADCDE
00000000000000010000000000000000	8#200000
00000000000010101011110011011110	2#10101011110011011110

E

EBOOL

EBOOL is the abbreviation of Extended BOOLean. An EBOOL type has a value (0 (FALSE) or 1 (TRUE), but also rising or falling edges and forcing functions.

An EBOOL variable occupies one byte in memory.

The byte contains the following information:

- one bit for the value;
- one bit for the history (whenever the object changes state, the value is copied to the history bit);
- one bit for forcing (equal to 0 if the object is not forced, or 1 if the bit is forced).

The default value of each bit is 0 (FALSE).

EF

EF is the abbreviation of Elementary Function.

This is a block used in a program which performs a predefined logical function.

A function does not have any information on the internal state. Several calls to the same function using the same input parameters will return the same output values. You will find information on the graphic form of the function call in the "[functional block (instance)]". Unlike a call to a function block, function calls include only an output which is not named and whose name is identical to that of the function. In FBD, each call is indicated by a unique [number] via the graphic block. This number is managed automatically and cannot be modified.

You position and configure these functions in your program in order to execute your application.

You can also develop other functions using the SDKC development kit.

EFB

EFB is the abbreviation of Elementary Function Block.

This is a block used in a program which performs a predefined logical function.

EFBs have states and internal parameters. Even if the inputs are identical, the output values may differ. For example, a counter has an output indicating that the preselection value has been reached. This output is set to 1 when the current value is equal to the preselection value.

Elementary function

See EF.

EN

EN stands for **EN**able; it is an optional block input. When the EN input is enabled, an ENO output is set automatically.

If EN = 0, the block is not enabled; its internal program is not executed, and ENO is set to 0.

If EN = 1, the block's internal program is run and ENO is set to 1. If an error occurs, ENO is set to 0.

If the EN input is not connected, it is set automatically to 1.

ENO

ENO stands for **E**rror **NO**tification; this is the output associated with the optional input EN.

If ENO is set to 0 (because EN = 0 or in case of an execution error):
- the status of the function block outputs remains the same as it was during the previous scanning cycle that executed correctly;
- the output(s) of the function, as well as the procedures, are set to "0".

F

FBD

FBD is the abbreviation of Function Block Diagram.

FBD is a graphical programming language that works like a flowchart. By adding simple logical blocks (AND, OR, etc.), each function or function block in the program is represented in this graphical format. For each block, the inputs are on the left and the outputs on the right. Block outputs can be linked to inputs of other blocks in order to create complex expressions.

FFB

Collective term for EF (elementary function), EFB (elementary function block) and DFB (derived function block).

FTP

File Transfer Protocol.

Function

See EF.

Function Block Diagram

See FBD.

G

Global Data

Global Data provides the automatic exchange of data variables for the coordination of PLC applications.

GRAY

The Gray code, or "reflected binary", is used to encode a numerical value developed in a string of binary configurations that may be differentiated by changing the status of a single bit.

For example, this code can be used to avoid the following random event: in pure binary, changing the value 0111 to 1000 may produce a range numbers between 0 and 1,000, given that the bits do not all change value at the same time.

Equivalence between decimal, BCD and Gray:

Decimal	0	1	2	3	4	5	6	7	8	9
BCD	0000	0001	0010	0011	0100	0101	0110	0111	1000	100
Gray	0000	0001	0011	0010	0110	0111	0101	0100	1100	110

H

HTTP

Hypertext Transfer Protocol

I

I/O scanning

An I/O scan continuously polls I/O modules to collect data bits and status, error, and diagnostics information. This process monitors inputs and control outputs.

IEC 61131-3

International standard: programmable logic controllers

Part 3: programming languages

IL

IL is the abbreviation of Instruction List.

This language is a series of basic instructions.

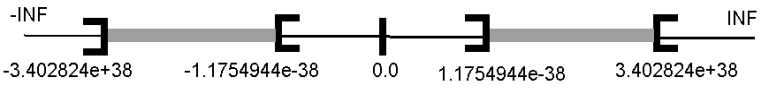
It is very close to assembly language used to program processors.

Each instruction is made up of an instruction code and an operand.

INF

Used to indicate that a number exceeds the authorized limits.

For an integer, the value ranges (shown in gray) are as follows:



When a result is:

- less than -3.402824e+38, the symbol `-INF` (for -infinity) is displayed;
- greater than +3.402824e+38, the symbol `INF` (for +infinity) is displayed;

INT

`INT` is the abbreviation of single INTeger (encoded in 16 bits).

The upper/lower limits are as follows: -(2 to the power of 15) to (2 to the power of 15) - 1.

Example:

`-32768, 32767, 2#1111110001001001, 16#9FA4.`

IODDT

IODDT is the abbreviation of Input/Output Derived Data Type.

The term IODDT indicates a structured data type representing a module or a channel of a PLC module. Each expert module has its own IODDTs.

K

Keyword

A keyword is a unique combination of characters used as a syntax element in a programming language (see the definition provided in appendix B of the IEC 61131-3 standard. All the keywords used in Unity Pro and included in the IEC 61131-3 standard appear in appendix C of that standard. Keywords cannot be used as identifiers [names of variables, sections, DFB types, etc.] in your program).

L

LD

LD is the abbreviation of Ladder Diagram.

LD is a programming language that represents instructions to be executed as graphical diagrams very similar to electrical diagrams (contacts, coils, etc.).

Literal value in base 10

A literal value in base 10 is used to represent a decimal integer value. This value may be preceded by the "+" and "-" signs. If the "_" character is used in the literal value, it is not significant.

Example:

`-12, 0, 123_456, +986`

Literal value in base 16

A literal value in base 16 is used to represent a hexadecimal integer. The base is determined by the number "16" and the "#" sign. The "+" and "-" signs are prohibited. To make it easier to read, you can use the "_" sign between the bits.

Example:

`16#F_F` or `16#FF` (decimal 255)

`16#E_0` or `16#E0` (decimal 224)

Literal value in base 2

A literal value in base 2 is used to represent a binary integer. The base is determined by the number "2" and the "#" sign. The "+" and "-" signs are prohibited. To make it easier to read, you can use the "_" sign between the bits.

Example:

`2#1111_1111` or `2#11111111` (decimal 255)

`2#1110_0000` or `2#11100000` (decimal 224)

Literal value in base 8

A literal value in base 8 is used to represent an octal integer. The base is determined by the number "8" and the "#" sign. The "+" and "-" signs are prohibited. To make it easier to read, you can use the "_" sign between the bits.

Example:

`8#3_77` or `8#377` (decimal 255)

`8#34_0` or `8#340` (decimal 224)

Literal value of a real

A literal real value is a number expressed with one or more decimals.

Example:

`-12,0, 0,0, +0,456, 3,14159_26`

Literal value of a real with an exponent

Number that may be expressed using standard scientific notation. In that case the representation is as follows: mantissa + exponent.

Example:

`-1.34E-12` or `-1.34e-12`

`1.0E+6` or `1.0e+6`

`1.234E6` or `1.234e6`

Literal value of an integer

A literal value of an integer is used to enter integer values in the decimal system. Values may be preceded by the "+" and "-" signs. Underscore signs (_) separating numbers are not significant.

Example:

`-12, 0, 123_456, +986`

Literal value of time

The TIME type has the following units: days (d), hours (h), minutes (m), seconds (s) and milliseconds (ms). A literal value of type TIME is represented by a combination of the preceding types prefixed with T#, t#, TIME# or time#.

Examples: T#25h15m, t#14,7S, TIME#5d10h23m45s3ms

M

Multitoken

Operating mode of an SFC. In multitoken mode, the SFC can have several steps that are active simultaneously.

N

Naming conventions (identifier)

An identifier is a series of letters, digits, and underscores starting with a letter or an underscore (e.g. the name of a function block type, an instance, a variable, or a section). Accented letters (such as ö, ü, é and õ) may be used, except in names of projects and DFBs. Underscore signs are significant in identifiers. For example, A_BCD and AB_CD are interpreted as different identifiers. You cannot use several underscores in succession or at the start of an identifier.

Identifiers cannot contain spaces. They do not differentiate uppercase and lowercase characters. For example, ABCD and abcd are interpreted as the same identifier.

According to the IEC 61131-3 standard, leading digits are not authorized in identifiers. However, you can use them if, from the **Tools** →**Project options** dialog box, in the **Language extensions** tab, you check the **Leading digits authorized** box.

Identifiers cannot be keywords.

NAN

Used to indicate that the result of an operation is not a number (NAN = Not A Number).

Example: calculating the square root of a negative number.

NOTE: The CEI 559 standard defines two classes of NAN: the `silent NAN` (`QNAN`) and the `signaling NAN` (`SNAN`). A `QNAN` is a `NAN` with a most significant fraction bit while an `SNAN` is a `NAN` without a most significant fraction bit (bit number 22). `QNAN`s can be propagated via most arithmetic operations without throwing an exception. As for `SNAN`s, they generally indicate an invalid operation when they are used as operands in arithmetic operations (see %SW17 and %S18).

Network

There are two meanings of the work "network".

- In LD:
  a network is a set of interconnected graphic elements. The scope of a network is local, concerning the organizational unit (section) of the program containing the network.
- With expert communication modules:
  a network is a set of stations that intercommunicate. The term "network" is also used to define a group interconnected graphic elements. This group then makes up part of a program that may comprise a group of networks.

P

Peer cop

Peer Cop service is a mechanism for automatic exchange between stations connected on the same Modbus Plus segment.

Procedure

Procedures are technically functional views. The only difference with elementary functions is the fact that procedures can include more than one output and that they handle the `VAR_IN_OUT` data type. In appearance, procedures are no different from elementary functions.

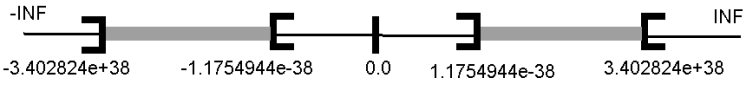
Procedures are an extension to the IEC 61131-3 standard.

R

REAL

The REAL type is encoded in a 32 bit format.

The possible value ranges are shown in the figure below:



When a result is:

- between -1,175494e-38 and 1,175494e-38, it is considered to be a DEN;
- less than -3.402824e+38, the symbol -INF (for - infinity) is displayed;
- greater than +3.402824e+38, the symbol INF (for + infinity) is displayed;
- undefined (square root of a negative number), the symbolNAN is displayed.

NOTE: The IEC 559 standard defines two classes of NAN: the silent NAN (QNAN) and the signaling NAN (SNAN). A QNAN is a NAN with a most significant fraction bit while an SNAN is a NAN without a most significant fraction bit (bit number 22). QNANs can be propagated via most arithmetic operations without throwing an exception. As for SNANs, they generally indicate n invalid operation when they are used as operands in arithmetic operations (see %SW17 and %S18).

NOTE: When a DEN (non-standardized number) is used as an operand, the result is not significant.

S

SFC

SFC is the abbreviation of Sequential Function Chart.

An SFC can be used to graphically represent in a structured manner the operation of a sequential PLC. This graphical description of the PLC's sequential behavior and of the various resulting situations is created using simple graphic symbols.

SIL

Safety Integrity Level

Safety functions are executed to achieve and maintain the safe state of a system. The IEC 61508 specifies 4 levels of safety performance for a safety function. These are called safety integrity levels (SIL), ranging from 1 (the lowest) to 4 (the highest). The Quantum Safety PLC is certified for use in SIL2 applications in which the de-energized state is the safe state, for example in an Emergency Shutdown (ESD) system.

You can use the Schneider safety products for creating a Hot Standby (HSBY) solution if you require high availability for a safety system.

Single token

Operating mode for an SFC diagram in which only one step can be active at a given time.

SNMP

Simple Network Management Protocol.

ST

ST is the abbreviation of Structured Text.

The structured literal language is a developed language similar to computer programming languages. It can be used to organize a series of instructions.

STRING

A `STRING` variable is a series of ASCII characters. The maximum length of a string is 65,534 characters.

T

TIME

The `TIME` type expresses a time in milliseconds. Encoded in 32 bits, this type can be used to obtain times from 0 to 2^{32}-1 milliseconds.

The `TIME` type has the following units: days (`d`), hours (`h`), minutes (`m`), seconds (`s`) and milliseconds (`ms`). A literal value of type `TIME` is represented by a combination of the preceding types prefixed with `T#`, `t#`, `TIME#` or `time#`.

Examples: `T#25h15m`, `t#14,7S`, `TIME#5d10h23m45s3ms`

TIME_OF_DAY

See TOD.

TOD

TOD is the abbreviation of Time Of Day.

The TOD type, encoded in BCD in a 32 bit format, contains the following information:

- the hour encoded in an 8 bit field;
- the minutes encoded in an 8 bit field;
- the seconds encoded in an 8 bit field.

NOTE: The 8 least significant bits are not used.

The TOD type must be entered as follows: **TOD#**<Hour>**:**<Minutes>**:**<Seconds>

This table shows the upper/lower limits of each field:

Field	Limits	Comment
Hour	[00,23]	The leading 0 is displayed; it can be omitted during data entry.
Minute	[00,59]	The leading 0 is displayed; it can be omitted during data entry.
Second	[00,59]	The leading 0 is displayed; it can be omitted during data entry.

Example: TOD#23:59:45.

Token

Active step in an SFC.

TOPO_ADDR_TYPE

This predefined type is used as an output for the READ_TOPO_ADDR function. This is an ARRAY[0..4] OF Int. You can find it in the library, in the same family as the EFs that use it.

U

UDINT

UDINT is the abbreviation of Unsigned Double INTeger (encoded in 32 bits). The upper/lower limits are as follows: 0 to (2 to the power of 32) - 1.

Example:

0,4294967295,2#11111111111111111111111111111111,8#37777777777,16#FFFFFFFF.

UDP

user datagram protocol. UDP is a connectionless Internet communications protocol defined by IETF RFC 768. This protocol facilitates the direct transmission of datagrams on IP networks. UDP/IP messages do not expect a response, and are therefore ideal for applications in which dropped packets do not require retransmission (such as streaming video and networks that demand real-time performance).

UINT

`UINT` is the abbreviation of the Unsigned INTeger format (encoded in 16 bits). The upper/lower limits are as follows: 0 to (2 to the power of 16) - 1.

Example:

`0, 65535, 2#1111111111111111, 8#177777, 16#FFFF.`

Unassigned variables

A variable whose position in the PLC memory cannot be known. A variable that is not linked to an address is called unassigned variable.

V

Variable

Memory entity of type `BOOL`, `WORD`, `DWORD`, etc., whose contents can be modified by the program currently running.

W

WORD

The type `WORD` is encoded in a 16 bit format and is used to perform processing on series of bits.

This table shows the upper/lower limits of each of the bases that can be used:

Base	Lower limit	Upper limit
Hexadecimal	16#0	16#FFFF
Octal	8#0	8#177777
Binary	2#0	2#1111111111111111

Examples of representation

Data	Representation in one of the bases
0000000011010011	16#D3
1010101010101010	8#125252
0000000011010011	2#11010011

Index

A

availability of the instructions, *23*
AXIS_REF, *30*

B

basic parameters, *35*

C

CAN_HANDLER, *39*

I

instructions
availability, *23*

L

Lexium-instructions
LXM_DOWNLOADMTASK, *92*
LXM_GEARPOS, *80*
LXM_GearPosS, *83*
LXM_STARTMTASK, *94*
LXM_UPLOADMTASK, *90*
LXM_DOWNLOADMTASK, *92*
LXM_GEARPOS, *80*
LXM_GearPosS, *83*
LXM_STARTMTASK, *94*
LXM_UPLOADMTASK, *90*

M

MC_HOME, *78*
MC_JOG, *67*
MC_MOVEABSOLUTE, *58*
MC_MOVEADDITIVE, *62*
MC_MOVERELATIVE, *60*
MC_MOVEVELOCITY, *65*
MC_POWER, *56*
MC_READACTUALPOSITION, *45*
MC_READACTUALTORQUE, *49*
MC_READACTUALVELOCITY, *47*
MC_READAXISERROR, *71*
MC_READPARAMETER, *41*
MC_READSTATUS, *75*
MC_RESET, *53*
MC_STOP, *54*
MC_TORQUECONTROL, *51*
MC_WRITEPARAMETER, *43*

motion-instructions
CAN_HANDLER, *39*
MC_HOME, *78*
MC_JOG, *67*
MC_MOVEABSOLUTE, *58*
MC_MOVEADDITIVE, *62*
MC_MOVERELATIVE, *60*
MC_MOVEVELOCITY, *65*
MC_POWER, *56*
MC_READACTUALPOSITION, *45*
MC_READACTUALTORQUE, *49*
MC_READACTUALVELOCITY, *47*
MC_READAXISERROR, *71*
MC_READPARAMETER, *41*
MC_READSTATUS, *75*
MC_RESET, *53*
MC_STOP, *54*
MC_TORQUECONTROL, *51*
MC_WRITEPARAMETER, *43*
TE_DOWNLOADDRIVEPARAM, *88*
TE_UPLOADDRIVEPARAM, *86*

S

status chart, *31*

T

TE_DOWNLOADDRIVEPARAM, *88*
TE_UPLOADDRIVEPARAM, *86*